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ABSTRACT

Current issues in educational communications and technology are addressed in this collection of 47 papers, in which research reports dominate. Topics discussed include factors related to the learner, e.g., problem-solving skills, motivation, comparison of instructional design strategies, effects of organizational cues and text layouts, and learning strategies. Several papers examine innovative educational media such as interactive video, electronic mail, teletraining, computer-assisted instruction, computer-generated text, simulations, and microcomputers. Additional papers discuss the use of cable television in higher education, noncommercial FM radio stations, instructional television services, use of bulletin boards and electronic mail in distance education, evaluation of media support services, user attitudes toward computers, and effects of Logo instruction. References and data tables are included with many papers. Cumulative indexes of authors and descriptors covering the first eight volumes of conference proceedings (1979-1986) for the Research and Theory Division of the Association for Educational Communications and Technology are included. (JB)

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PREFACE

For the eighth year, the Research and Theory Division of the Association for Educational Communications and Technology (AECT) is publishing these Proceedings. Papers published in this volume were presented at the national AECT Convention in Las Vegas, NV. A limited quantity of this volume were printed and sold. It is also available on microfiche through the Educational Resources Information Clearinghouse (ERIC) system.

REFEREEING PROCESS: All Research and Theory Division research papers selected for presentation at the AECT Convention and included in this Proceedings were subjected to a rigorous blind reviewing process. Proposals were submitted to Dr. Melvin Bowie of the University of Arkansas, who coordinated the review process. All references to author were removed from proposals before they were submitted to referees for review. Approximately sixty percent of the manuscripts submitted for consideration were selected for presentation at the Convention and for publication in these Proceedings. The papers contained in this document represent some of the most current thinking in educational communications and technology.

This volume contains two cumulative indexes covering the first eight volumes, 1979-1986. The first is an author index. The second is a descriptor index. The two indexes will be updated in future editions of this Proceedings.

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TABLE OF CONTENTS

Effectiveness of Interactive Video in Teaching Basic Photography Skills
By Arnie Abrams 1

Effect of Pictures on Recall of Written Prose: How Durable are Picture Effects?
By Gary J. Anglin 15

The Display of Color Graphics on Monochrome Monitors: A Concern for Designers and an Opportunity for Researchers
By Patti R. Baker, John C. Belland and Marjorie A. Cambre 36

Instructional Film Research and the Learner
By Melvin McKinney Bowie 49

External Pacing as an Instructional Strategy for the Design of Micro-Computer Based Instructional Programs to Improve Performance on Higher Level Instructional Objectives
By James Canelos, Patti Baker, William Taylor, John Belland and Francis Dwyer 65

An Assessment of Nursing Attitudes Toward Computers in Health Care
By David L. Carl, Rachel R. Carl and Sherry Greathouse 85

Research on Teletraining: Student Acceptance, Learning Effectiveness and Cost Benefits in the Corporate Environment
By Alan G. Chute 106

A Comparison of the Effects of Logo Use and Teacher-Directed Problem-Solving Instruction on the Problem-Solving Skills, Achievement, and Attitudes of Low, Average, and High Achieving Junior High School Learners
By David W. Dalton 119

The Effects of Video-Only, CAI Only, and Interactive Video Instructional Systems on Learner Performance and Attitude: An Exploratory Study
By David W. Dalton and Michael J. Hannafin 153

Word Processing and the Writing Process: Enhancement or Distraction
By David W. Dalton and James F. Watson 166

A Comprehensive Study of the Operational Problems of Higher Education Affiliated Cable Television Stations
By Kurt P. Dudt and Richard J. Lamberski 185

A Methodology in Studying Higher Education Affiliated Cable Television Stations
By Kurt P. Dudt and Richard J. Lamberski 195

Selecting Media For Instruction
By L.J. Evans 210

Feasibility Study of Bulletin Board and Electronic Mail Technologies for the Improvement of Student/Instructor Communications Used in "Distant" Education Course Offerings
By C. Hugh Gardner and Murray H. Tillman 220

The Accuracy of Cognitive Monitoring During Computer-Based Instruction
By Casey Garhart and Michael Hannafin 230

A Time Management Study
By Helen M. Gothberg, Donald E. Riggs and Lawrence M. Aleamoni 252

Relationships Among Text Format Variables in Computer-Generated Text
By R. Scott Grabinger 271

Extending Graduate Level Education: A Management Model
By Robert L. Hales and Stephen B. Felt 302

A Comparison of Task Analysis, Advance Organizer, and Concept Elaboration Methods in Teaching Concepts and Principles
By Walter V. Hanclosky 313

The Effects of Presentation Latency and Embedded Orienting Strategies on Learning from Computer-Based Instruction
By M. Hannafin, T. L. Phillips, L. P. Rieber and C. Garhart 336

The Effect of Fluid Ability, Visual Ability, and Visual Placement Within the Screen on a Simple Concept Task
By Russ A. Hart 358

Collecting Mapping in School Library Media Centers
By May Lein Ho and David Loertscher 390

Principals' and Teachers' Attitudes Toward Kansas School Media Libraries
By John A. Hortin 410

Longitudinal Curriculum Changes in Instructional Design and Educational Psychology Doctoral Programs
By J. Daniel House, and Barry Bratton and Craig L. Gjerde 421

Effects of Microcomputer Display on a Perceptual/Cognitive Task
By David H. Jonassen 451

State Anxiety an Exposure to Microcomputers: Assessing Computerphobia
By David H. Jonassen.. 461

List Verses Flow Chart Representations of Algorithms for a Search Task
By David H. Jonassen and Marilyn Pearson................................ 469

The 1983-84 Maryland ITV Study Summary Report
By Paul E. Jones 478

Descriptive Study of Noncommercial FM Radio Stations Affiliated with Colleges and Universities
By Mary Beth Leidman and Richard J. Lamberski 490

A Methodology in Studying Noncommercial FM Radio Stations -- A Case Study
By Mary Beth Leidman and Richard J. Lamberski 505

Effects of Selected Filmic Coding Elements of TV on the Development of the Euclidean Concepts of Horizontality and Verticality in Adolescents
By Beth Eloise Lynch 521

Memphis State Regression Computer-Managed Instruction Model
By Gary R. Morrison and Steven M. Ross 530

Instructional Strategies in CAI: Instructional Design Theory Needs
By Tillman J. Ragan 542

Evaluating Media Support Services: An Ethnographic Approach
By James P. Randall 552

The Effect of Logo on Young Children
By Lloyd P. Rieber 562

Interactive Cable Television: An Evaluation Study
By Rhonda S. Robinson and Peter C. West 598

What Your Professor Never Told You About the Mundane Practice of Instructional Design
By Allison Rossett 612

Microcomputers and Continuing Motivation
By Sherrie L. Seymour, Howard J. Sullivan, Naomi O. Story and Mary Lou Mosely 620

The Effects of Organizational Cues on Learners' Processing of Instructional Prose
By Patricia L. Smith 635

Instructional Simulation: Research, Theory, and a Case Study
By Peter Smith 656

"Newscast From the Past": A Dynamic New TV Series with a Global Perspective on World History
By Drew Tiene 721

Using Television to Develop "The High School of the Future"
By Drew Tiene 745

Old Wine in New Bottles: Subliminal Messages in Instructional Media
By Margaret Treimer and Michael R. Simonson 763

Educational Computing inservice Design: Implications from Teachers' Concerns Research
By John F. Wedman 782

Graduate Student Contributions to AECT and to the Future of Educational Technology
By Paul W. Welliver 797

Emerging Trends in Educational Technology Research
By William Winn 801

Learner Environment Fit: University Students in a Computer Room
By Andrew R. J. Yeaman 833

Cumulative 1985-86 Author Index 848

Cumulative 1979-84 Author Index 854

Cumulative 1985-86 Subject Index 866

Cumulative 1979-84 Subject Index 872

EFFECTIVENESS OF INTERACTIVE VIDEO IN TEACHING BASIC PHOTOGRAPHY SKILLS

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Introduction

The introduction of a new instructional technology has historically been followed by immoderate claims about the impact and effectiveness of that technology. This has occurred with motion pictures, television and computer-assisted instruction. The latest extravagant claims are for interactive video; a medium that combines the processing power of a microcomputer with the visual and auditory strength of videotape or videodisc (Grabowski, 1984; Leveridge, 1979; Waldrop, 1983). As with other media, the early years of implementation are filled with extreme claims, inappropriate applications, and enormous promise.

Bold predictions about interactive video have been made, but few studies have actually been conducted to validate or refute these claims. A preponderance of the literature is based on anecdotal accounts and is often written from a stance of advocacy (Bosco, 1984). This study addressed the need for systematic research to measure the effectiveness of interactive video as an instructional tool.

Purpose of the Study

The major purpose of this study was to assess the effectiveness of interactive video in the teaching/learning process. More specifically, a comparison was made of the relative effectiveness of interactive video and linear video as delivery modes in the acquisition of basic photography skills in an independent learning environment at a college level.

A second impetus for the study stemmed from the wide diversity of photography skills and experience typically possessed by the students in the population. For many students who have no prior photographic experience, traditional group instruction proceeds too rapidly; for others with considerable experience, the instruction will often be repetitive. This diversity suggested the need for an alternative mode of delivery. The investigator postulated that a self-instructional, self-paced approach would be beneficial for both novices and experienced photographers.

Research Objectives

The primary objectives of this study were :

1. To determine if there is a significant difference ($p. < .05$) in achievement between students who receive instruction using an

interactive video mode and those using a linear video mode.

2. To determine if there are significant differences ($p. < .05$) in attitudes about the instruction between students using an interactive video mode and those using a linear video mode.
3. To analyze the factors which contribute to the difference in achievement between the groups.
4. To analyze factors contributing to the differences in attitudes between the groups.

Procedures

In this study, students enrolled in a teacher education program received instruction in basic photography skills in one of two methods. The control group (N=64) received instruction in an independent learning environment via a linear videotape (LV). The experimental group (N=64) also received instruction in an independent learning environment but via interactive video (IV). Interactive video refers to computer-controlled video which allows branching of the program for remediation or enrichment (Floyd,1980; Levenson, 1983; Troutner, 1983). The tapes were produced by the investigator and the content of both tapes was nearly identical.

Using a random number table (Borg and Gall, 1983), students were assigned to experimental and control groups. Participants then completed a 25-item written multiple-choice test (pre-test) covering key concepts incorporated in the videotapes. Subjects waited five to seven weeks before watching the appropriate videotape. Students were given an alternative form of the same test (post-test) immediately following the treatment. Analysis of covariance was used to compare achievement of the control group with that of the experimental group. The pretest was used as a covariate in order to adjust for initial differences between groups, reduce sampling error, and to give a more precise estimate of post instructional performance (posttest).

Participants also completed an attitude survey. This form offered insights into students' perceptions concerning the instruction. The written reaction form was measured on a five-point Likert scale, and related to such items as rate of instruction, frustration level, technical problems, and motivation. Significance of between group differences on individual items was tested using the Mann--Whitney U test, and ordinal consensus was measured using a Leik scale.

Results

Achievement

Results indicated that the IV group recorded significantly and consistently larger achievement gains than did the LV group. There was a difference in means between pretest and posttest scores of 29.70 (from 49.80 to 79.50) points for the linear group as compared to 35.81 (48.94 to 84.75) for the IV group (Table 1). The average difference of 6.11 points in favor of the IV group, is significant at the .001 level (F=10.48). The ANCOVA table (Table 2) shows a highly significant F ($p. < .001$), which indicates a low probability that these differences were due to chance.

Table 1

Comparison of Pretest, Posttest, and Adjusted Posttest Means

Group	Pretest Mean	Posttest Mean	Adjusted Post Mean	N	Gain	Gain Diff.
IV	48.94	84.75	84.95	64	35.81	6.11
LV	49.80	79.50	79.30	64	29.70	

Table 2

Analysis of Covariance - Treatment Effect

Source of variation	Adjusted Df	Adjusted SS	Adjusted MS	Computed F	Tabular F
Between Groups	1	1017.33	1017.33	10.48	3.90
Within (Error)	125	12131.62	97.05		
Total	126	13148.95			

Significance 0.0019

Summary of Attitude Results

As some researchers have noted, interactive video may prove to make more of a difference in attitude than achievement (Bosco, 1984; Yeany et al., 1980). Findings from this study support this contention.

Although the attitude survey cannot accurately produce an overall measure, it is possible to get a comparative profile of student's perceptions of each method by tallying survey responses. Of 28 items on the survey concerning the perceived effectiveness, dependability, and motivation of each method, 16 were found to have significant differences in Mann-Whitney U levels ($p. < .05$). Items with the largest significance levels generally also had the greatest differences in means; in fact the first nine ranks were identical for both ranking methods (Table 4). Twenty-three group means were higher for the IV group, compared to 5 for the LV. On agreement levels, 21 levels were higher for the IV group compared to seven for the LV.

Examining the levels of significance and between group differences may be informative. Of the 28 items, 16 items were significant at the .05 level, and 11 of those items had a difference greater than .4 of a category, all except one of these means were higher for the IV group. These need to be considered with some caution. Five of those items involved questions which were substantially different for each group. These data would indicate that student perception was higher for the interactive video method than for the linear video method.

Of the 28 items, between group levels of agreement showed differences above .15 on six items, five favored IV and one the LV group. Of these six items, five also had a between group disparity in means above .4. Of the seven testing related items, two were above .15 in agreement differences, and both favored LV. Of 21 items which involved student's reaction to the same question, only two had differences in agreement levels above .15 (.19 and .15). This indicates great similarity in item agreement levels between groups.

Table 3

Sample of Attitude Question Data Treatment

5. While watching this program I felt challenged to do my best.

	Strongly disagree	Disagree	Uncertain	Agree	Strongly agree	N/A
IV						
Freq	0	1	5	51	7	
%	0	1.5	7.8	79.6	10.9	
Cum. %	0	1.5	9.3	89	100	
Likert Mean	4			Agreement	.89	
LV						
Freq	2	9	11	38	4	
%	3.1	14	17.1	59.3	6.2	
Cum. %	3.1	17.1	34.3	93.7	100	
Likert Mean	3.51			Agreement	.695	
Between Group Differences						
Likert Mean	.49			Agreement	.195	
z score	2.90			Significance	.002	

Discussion The difference in between group means on this item was considerable (.49) and highly significant (.002). It would appear that students felt more challenged, more consistently (agreement difference .195) to do their best with the IV treatment...

Table 4

Key Attitude Differences
Ranked by Degree of Significance

Sig.	Same Q.	Item #	Content	Diff	Diff Rank
.0001	N	15	computer questions helpful/ review questions would have been helpful	1.70	1
.0001	N	14	method of feedback monotonous/ liked a discussion after instruction	1.54	2
.0001	N	19	could have learned just as well without computer features/ would be better with review questions or simulation	1.5	3
.0001	N	12	usefulness of simulation/ examples of 27 different pictures	1.2	4
.0001	N	16	dreaded missing review question/ would be helpful to review sections	1.18	5
.0001	Y	13	enough control over rate and sequence of instruction	.93	6
.0002	Y	18	more interesting than traditional methods	.54	7
.001	Y	28	how long could work effectivly with method	.52	8
.002	Y	5	challenged to my best	.49	9
.003	Y	2	mechanical malfunctions	-.25	17
.005	Y	20	prefer method to tradtional instruction	.48	10
.007	Y	17	felt someone was engaged in conversation with me	.43	11
.01	Y	27	like to learn other subjects with method	.31	13
.02	Y	10	too much material presented	.37	12
.03	Y	11	"Gallery" sequence useful	.30	15
.03	Y	25	best approach to use for learning photo	.28	16

Key attitude differences concerned level of learner control, level of interaction, and preference over traditional methods of instruction. IV students indicated a substantial degree of agreement (high consensus level) on several factors including the following items:

* For learning about photography I would prefer IV to traditional instruction.
* IV made it possible for me to learn more quickly than traditional methods.
* In view of the time and effort I put into it, I was satisfied with what I learned via this method.
* I felt I had enough control over the rate and sequence of the material.
* The computer-related features (review questions and a picture taking simulation) were important in helping me learn.

Time efficiency was not increased with interactive video. The LV group all took 30 minutes to watch the tape, the IV group's time ranged from 34 minutes to 70 minutes with an average of 49 minutes.

Possible Reasons for Achievement Differences

Practice and Repetition: Many researchers have noted that practice and repetition facilitate learning. The interactive video method offered these attributes through the use of review questions, remediation of material, and options to review sections. One could argue that in large part the increased effectiveness of the IV system is due to the student getting an opportunity to first be quizzed on the material (questions in the IV program were different than those on the achievement test). Additionally, the picture-taking simulation offered synthesis of the information and an opportunity to apply the information.

Attentiveness: With linear video the viewer can "tune out" the program or become easily distracted. The interactive video program used in this study required mastery learning; if the viewer did not pay attention and kept missing review questions it would take longer to proceed through the instruction. It would appear that interactive video could help increase concentration for viewers with low motivation, however this may come at the price of increased anxiety and stress. Subjects in this study, for the most part, did not indicate that they dreaded missing a review question, in fact several students commented that they enjoyed the challenge, and the chance to review their understanding of the material before being tested.

High Level of Interaction: Many researchers have noted that participatory experiences aid learning. Anandam and Kelly (1981) noted that interactive video "changes the student from passive observer to active participant" (p. 3). However, Bosco (1984) cautions that just because interactive video requires the student to utilize a keyboard, equating motor response with active participation trivializes the notion of what is active and what is passive in learning situations. In some cases existing programs have become "interactive" by simply adding menus or review questions. In this study, the program was specifically designed to incorporate a high level of interaction, including a simulation of taking a picture.

High Quality of Software: Ultimately the effectiveness of any medium will be determined by the quality of software utilized. This has been evident in the inability of educational films, television, and possibly CAI to reach their full potential. From student responses, it is apparent that there was a high level of satisfaction with the programs used in this study. By careful design both programs were nearly identical in approach and content. However, the interactive videotape utilized the attributes of computer-related features.

Possible Reasons for Attitude Difference

There were 16 significant attitude differences. For purposes of explanation these can be grouped into five main areas:

Level of Learner Control: Quite evidently one factor in the difference between groups was that the linear video group effectively had no control over rate or sequence of instruction, while the computer-related features of the interactive video system afforded that group some degree of learner control. Several IV subjects indicated that they would prefer greater control over program pacing, however 78 per cent of them either agreed or strongly agreed that they felt enough control. The issue of amount of control to offer the learner remains a controversial and important issue for designers and would make an excellent topic for further study.

Opportunity for Review Questions, Feedback, and Review Sections: The LV group indicated a high desire for opportunities for review and practice. This was the most commonly cited shortcoming of the linear video method. The IV group exhibited a high level of agreement that the review questions and review sections were helpful to them, and that interaction with the IV system was positive and reinforcing.

Preference over Traditional Instruction: The difference in preference of the method used over traditional methods (illustrated lecture) favored the IV group by .484 and was significant at the .005 level. This can be due to several factors. Certainly one factor is novelty; the concept of using a videotape recorder connected to a microcomputer was enticing to many learners. However, the Hawthorne effect may not be germane because data indicated that learning via videotape was also novel to most participants. Students in the population typically had more exposure to computers than instructional television. A more important factor might have been the interaction afforded by the computer. Research on CAI has shown that the holding power of computers is in large part due to the interactive nature of the technology. In this study, the IV group had a higher perception that someone was involved in a conversation with them while receiving instruction than did the LV group (difference .437, significance .007). It may be interpreted that the computer-assisted video instruction was perceived as being more humanizing, individualized, and personal than did the linear system.

Challenge to do Best: The IV group felt more challenged to do their best while watching the program than did the LV group (difference .49, significance .002). It is believed that this can be directly attributed to the IV students needing to correctly answer review questions to proceed with instruction. As mentioned above, whether this is a trade off for increased anxiety is a concept worthy of further study.

Time Able to Effectively use the Method: It is interesting to note that each group felt they could work effectively with the method approximately the amount of time that it actually took to watch the program. For the LV group this was thirty minutes, and for the IV group the average time on instruction was about fifty minutes. It may be that students had the perception of being able to effectively longer work with the IV system because of being an active learner. In education it is a maxim that "involvement precedes interest", and this may have been the case in this study. It may be discovered that instruction may take longer with interactive video, but because learners are active and not passive, they can work longer effectively.

Implications for Further study

Retention: Achievement measures in this study measured only immediate recall of information. Testing took place immediately following treatment. A larger question would be the comparative effectiveness of methods in retention testing.

Cost-benefit, Time Effectiveness: Although this study demonstrated that interactive video can increase instructional effectiveness, it did not explore the issues of cost or time effectiveness. Interactive video is more complicated to produce than almost any other medium of instruction, and development and production costs are proportionally higher, typically as much as four times greater than CAI or linear video. However, the high development costs can be offset by repeated use of the materials and the automation of some instruction. Therefore, interactive video may be attractive to trainers who need to provide the same instruction to large number of persons at many different cites.

Increased station cost is also a drawback of interactive video. An interactive video system costs more than twice as much as a linear video system. This high station cost may make interactive video inappropriate for training or instructional situations where numerous stations are needed and funds are limited.

This study found an increase in instructional effectiveness of IV of about 17 per cent over LV. This increase may not be large enough in many situations to justify the added expense. Time on instruction was also higher for the IV group than the LV group, about 50 per cent higher. In many instances this may not be an acceptable trade off.

Attitude vs Achievement: Research in computer-assisted instruction has indicated that CAI may make a larger difference in learner attitude than in achievement. This may also prove to be true for interactive video. This study did not compare the level of significance between the two different research questions. It may be that interactive video's largest benefit is not its instructional effectiveness, cost effectiveness, or time efficacy, but in its ability to motivate and involve students.

Factor Analysis: This study addressed the question of how interactive video compares to linear video in instructional effectiveness and student perceptions. A more focused question is why was interactive video more effective than linear video. This chapter has offered some insights into probable causes for differences in results between the two methods. These projections are based on: data from the attitude surveys, student comments, personal experience, and intuitive judgment. Research should be conducted to provide a formal factor analysis to assess the reasons behind the performance of interactive video. This could be accomplished by altering the design of interactive videotapes and testing single attributes of interactive video. Below are several aspects which could be varied to test for their individual effect.

Varying Learner Control: Throughout this paper the point has been reiterated that the amount of learner control to give students is a key issue for designers of interactive video materials. It would be beneficial to determine if there is a direct relationship between level of learner control and student achievement. This would have implications far beyond just interactive video instruction. With interactive video this level could be modified by offering students varying levels of control over program pacing, sequence, and feedback. Students could be offered more control over what method of instruction to use or whether review sections would be optional or automatic.

Varying Level of Interactivity: Another interesting question would be if there is a direct relationship between level of interactivity and achievement. By comparing programs with varying levels of interactivity the effect of learner interaction on achievement could possibly be isolated. Variable factors could involve comparing the use of review questions to the use of simulations, or the use of multiple-choice questions versus inquiry questions.

Group Instruction: This study examined only individualized instruction, yet interactive video may have some important implications for group instruction also. Field testing the materials utilized in this study involved comparing IV individualized instruction to IV used in a class environment. In the group instruction answers to questions were derived from a consensus of the group. A short amount of time was allowed for questions and discussion with the instructor. Although adequate controls were not maintained, this experiment did find that the mean for the IV group treatment was only four points lower than that for the IV individualized method. Given the cost and complexity of delivering individualized instruction it would be beneficial to compare these two different forms of delivery.

Mechanical Dependability: In this study nearly twenty per cent of IV students experienced at least some mechanical malfunction. For many training situations this would be an unacceptably large figure. Before large scale implementation of interactive video instruction is conducted it would be beneficial to determine the mechanical reliability of different systems.

Brevity of Instruction: Barbara Fowler (1980) in her doctoral dissertation noted that due to the brevity of instruction generalizations are limited to instruction of similar length. In her case, as well as this study, instructional sequences occurred over a 30 to 50 minute time span. Further research should be conducted utilizing instruction given under other time conditions.

Replicability: Research in the social sciences has often been criticized for its lack of replication. Interactive video has been especially susceptible to this. At the time of this writing only eight other dissertations on interactive video had been written. Interactive video offers a relatively facile way to replicate a study because the same materials can be reemployed. It would also be worthy of investigation to administer the same materials to different populations.

Different Populations and Subject Matter: Interpretation and generalization of results from this study is limited to data obtained from students enrolled in a teacher education program instructed in basic photography skills. Other studies should be conducted to determine the relative effectiveness of interactive video with different populations and with different subjects of instruction. It may be discovered that a particular medium is good at teaching some concepts to some learners and not good at others. This is an area of research that CAI research is just beginning to focus on.

Applications of Interactive Video: Determining the proper application of interactive video may be as important as investigating the relative effectiveness of the medium. As the research in CAI and instructional television has shown, proper design of software and wise application of the medium can be the decisive factor in determining the effectiveness of a technology. A relevant question is "Should we be using interactive video based instruction or interactive video assisted instruction?". Research on CAI has shown that computer-assisted instruction has been more effective than computer-based instruction. Indeed in this study, in which instruction was IV based, many students indicated the desire for discussion, hands-on experience, and live question-and-answer sessions. The attribute-treatment interaction could be studied to determine what kind of student learns best from interactive video. Additionally, the level of use needs to be explored. There are at least three distinct utilization levels: class level, unit level, and lesson level. Bosco feels that ultimately interactive video will be more beneficial utilized as learning modules rather than replacing entire courses of study.

Use in Conjunction with Other Media: In reality, most educators and trainers draw on a variety of methods and media. Studying an instructional technology in isolation is to some degree an academic exercise. Research should be conducted to determine the effectiveness of interactive video when used in concert with other media. Although it is difficult to conduct multi-variate research, it is essential that it be done because actual learning and teaching will ultimately be delivered in the real world of multi-sensory environments. Only then will interactive video be able to come out of the research lab and into the real world of training and education.

Conclusion

In this study interactive video was shown to be more effective than linear video in teaching basic photography skills to students enrolled in a teacher education program. Significant improvements were measured in both achievement and attitude. This study demonstrated that interactive video can be a very powerful and effective training method, given certain considerations. These considerations are essential issues in the effective use of the medium. Interactive video materials must be designed and produced to address the unique characteristics and strengths of the medium; it must be utilized effectively, converging the capabilities of the technology with the nature of the educational task; and it must be used in conjunction with other media and methods, taking into consideration the total learning environment and learner characteristics. Ultimately, it is the instructional methods that interactive video facilitate that will be the strength of the medium. In concluding, it is worth reiterating J.J. Bosco's advice to potential designers, producers, and users of interactive video:

> In order for the technology to be used effectively, we need to get beyond the statements of the first generation of advocates to more careful considerations. If interactive video is to become a useful tool in education, and not a mere toy or plaything, we need reasoned analysis as much as enthusiasm.

Hopefully this study will serve as a pioneering effort in the reasoned analysis of interactive video, and will aid in the transformation of the medium from technological plaything to educational tool.

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Effect of Pictures on Recall of Written Prose:
How Durable are Picture Effects?

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Running head: DURABILITY OF PICTURE EFFECTS

Abstract

There is now substantial evidence that pictures can be used to facilitate the recall of information presented in prose passages. There is also evidence that the presence of pictures in prose passages does not hinder the recall of information that is not pictured. Are the picture effects durable over longer periods (55 days) of time? Do pictures included in prose passages help or hinder subjects recall of information that is not pictured? Results of this study provide evidence that picture effects are durable. In addition, the inclusion of pictures in prose passages did not interfere with the recall of information presented only in the prose passage.

Effects of Pictures on Recall of Written Prose:
How Durable are Picture Effects?

Results from prose learning studies examining the contribution of pictures to the recall of prose materials provide considerable empirical evidence that pictures can be used to facilitate the recall of information presented in prose passages (Alesandrini, 1984; Levie & Lentz, 1982; Levin, 1981; Levin & Lesgold, 1978). In an integrative review of research on the effects of text illustrations, Levie and Lentz (1982) report that "the results of 46 comparisons of learning illustrated text information from passages with and without pictures reveal an overwhelming advantage for the inclusion of pictures" (p. 203).

Levin (1981) has provided a theoretical framework which distinguishes between seven functions that prose-relevant-pictures may serve. The seven functions identified by Levin include: decoration, remuneration, motivation, reiteration, representation, organization, interpretation, and transformation. According to Levin (1981), "Two of these functions (the representation function and the transformation function) have proved useful in differentiating between the magnitude and consistency of picture effects that can be anticipated from one prose-learning study to the next" (pp. 225-226). The function of a representational picture would be to make the information in the prose passage more concrete. Levin (1981) suggests that the contribution of representational pictures to improved prose learning would be moderate. Pictures serving a transformation function would make the information in the prose passages more memorable. The predicted prose learning improvement using pictures serving a transformation function would be substantial (Levin, 1981).

This study investigated the possible contribution of pictures serving a representation function to the recall and retention of information presented in written prose passages. The primary variable considered in this study was the durability of picture effects. Peng and Levin (1979) pointed out that "in order to prove implications for classroom-learning situations, it must be demonstrated that gains attributable to pictures are not short-lived" (p. 39). Kerst and Levin (1973) have demonstrated the durability of picture effects using a paired-associate learning tasks with children as subjects. Using a more ecologically valid story-recall task, Peng and Levin (1979) reported that picture effects found with second graders were durable over a 3-day period. Levin and Berry (1980) also found picture effects to be durable over a 3-day period. Using representational pictures, Anglin (in press) reported significant picture effects which were durable over 14 and 26 days. Based on the results of studies by Peng and Levin (1979), Levin and Berry (1980), and Anglin (in press), it was hypothesized for the current study that representational picture effects would be durable over a 55-day delay. It was also predicted that the magnitude of the picture effects would be moderate based on Levin's (1981) theoretical discussion of potential picture functions.

A secondary variable considered in this study concerned the potential effect the presence of pictures had on the recall of information that was not pictured. Based on the results of 10 studies, Levie and Lentz (1982) concluded that "illustrations have no effect on learning non-illustrated text information" (p. 203). A closer examination of the 10 studies reveals that subjects for 7 of the 10 studies were children in grades

K-6. The three studies including older learners used cartoons as the illustrations. Can the lack of picture facilitation or interference found with young children be extended to older learners (college students) if the illustrations are text-redundant pictures instead of cartoon embellishments? It was hypothesized that the presence of pictures would neither facilitate or hinder subjects recall of information which was presented _only_ in the passage and _not_ pictured.

This study investigated the limits of durability for significant picture effects. The durability of picture effects was examined over a 55 day period. In addition, the effects of pictures on the recall of information presented in the text _only_ was examined.

Method

Subjects and Design

Subjects were 30 graduate students from a southeastern university. The participants were randomly assigned to one of two groups--prose-plus-picture (16 subjects) and prose-only (14 subjects). In the prose-plus-picture group, subjects read the prose passage and viewed a representational picture (line drawing). In the prose-only group the participants read the prose passage without the relevant picture.

Materials

The three prose passages used by Anglin (in press) were also used in the current study. The passages were human interest stories which varied in length from one-half to three quarters of a page, typed, and double-spaced. The passages were selected from Time, a weekly news magazine. Topics discussed in each of the three passages concerned skateboarding, Santa Claus and Christmas, and an individuals attempt to set up residence on a traffic island on Manhattan.

The same line drawings used by Anglin (in press) were used in the current study (one drawing per passage). The drawings were designed to function as representational pictures, i.e. pictures whose function is that of making the prose passage more concrete (Levin, 1981). An example of the picture used for the traffic island passage is presented in Figure 1.

Insert Figure 1 about here

The 15 paraphrase questions (5 per passage) used by Anglin (in press) were also used in this study. The 15 questions tested recall of information (text-redundant) that was presented in the prose passage and represented in the picture. An example of one of the Text-redundant Test items for the traffic island passage follows:

> On what object or structure did the man
> set up residence?

Five additional short-answer paraphrase questions were constructed for each of the three passages (5 items per passage). The 15 new items were designed to test the recall of information which was presented in the prose passage that was not represented in the accompanying picture. An example of one the the Text-only Test items for the traffic island passage follows:

> Where was the man finally taken?

It was previously demonstrated that subjects could not correctly answer the 15 questions which tested the recall of information which was presented in the passage and represented in the picture without reading the prose passage and/or viewing the picture (Anglin, in press). Prior to the administration of the current experiment, the 15 new paraphrase questions designed to test for recall of information presented in the text but not represented in the pictures were administered to a group of 12 graduate students to verify that these new questions could not be correctly answered by individuals who had not previously received any treatment. Average recall for the 12 graduate students was 2%.

Procedure

Subjects were tested in a group format. In both the prose-plus-picture and prose-only groups, subjects were instructed to read the prose passage once. In the prose-plus-picture condition, subjects were also instructed to view the accompanying picture. The passage orders were counter-balanced across subjects. When a subject completed reading one passage the 10 item test for that passage was administered. The same procedure was used for passages two and three. Fifty-five days later, the subjects were tested in the same manner using the same 30-item test (10 items per passage) used in the immediate condition. In the delayed testing condition subjects did not re-read the stimulus materials.

Results

The analyses were performed in two stages. The first analysis examined the possible effect that Treatment and Time of Test had on prose recall scores for the dependent variable Text-Redundant Test score. The second analysis also examined the effect that Treatment and Time of test had on prose recall for the dependent variable Text-only Test score

The first analysis was a 2 (Treatment) x 2 (Time of Test) repeated measures analysis of variance (ANOVA) using each subjects' prose recall score for the Text-redundant Test as the dependent variable. Treatment (prose-plus-picture, prose-only) was the between-subjects factor, while Time of Test was the within-subjects factor. Cell means and standard deviations from this analysis are presented in Table 1. The ANOVA yielded significant main effects for: Treatment, $F(1, 28) = 9.36$, $p < .01$; Time of Test, $F(1, 28) = 98.92$, $p < .001$. The two-way interaction: Treatment by Time of Test was not significant, $F(1,28) = .22$, $p > .05$

Insert Table 1 about here

The marginal means for Treatment indicated that subjects' average recall was greater in the prose-plus-picture condition ($\underline{M}$ = 10.38) than in the prose-only condition ($\underline{M}$ = 8.45). Marginal means for the within-subjects factor Time of Test indicated that subjects average recall was greater in the immediate ($\underline{M}$ = 12.30) than in the delayed ($\underline{M}$ = 6.40) testing condition. Given the hypothesis of durable picture effects, tests of simple main effects (Dixon, 1983) were performed to directly compare the prose-plus-picture group with the prose-only group for the immediate and delayed testing conditions. Average recall for prose-plus picture subjects ($\underline{M}$ = 13.18) was significantly higher ($\underline{p} < .05$) than average recall for prose-only subjects ($\underline{M}$ = 11.53) in the immediate testing condition. In the 55-day delayed testing condition, the average recall of prose-plus-picture subjects ($\underline{M}$ = 7.57) was also significantly higher than that of prose-only subjects ($\underline{M}$ = 5.38) with $p < .05$.

The second analysis was a 2 (Treatment) x 2 (Time of Test) repeated measures analysis of variance using each subjects' prose recall score for the Text-only Test as the dependent variable. The 15 items in the Text-only Test were designed to measure the recall of information presented in the text but not represented in the pictures. Treatment (prose-plus-picture, prose-only) was the between subjects factor; Time of Test was the within-subjects factor. Cell means and standard deviations from the second analysis are presented in Table 1. The ANOVA yielded a significant main effect for Time of Test, $F(1,28) = 241.69$, $p < .001$. The main effect Treatment was not significant, $F(1,28) = .32$, $p > .05$. The two-way interaction: Treatment by Time of Test was not significant, $F(1,28) = 1.30$, $p > .05$. The marginal means for the within-subjects factor Time of Test indicated that subjects average recall was greater in the immediate ($M = 11.90$) than in the delayed ($M = 4.52$) testing condition.

Discussion

The two variables considered in this study were: a) durability of picture effects, and b) the potential effect the presence of pictures had on recall of information that was _not_ pictured. The discussion concerning the durability of picture effects is based on the first analysis which included _Text-redundant Test_ score as the dependent variable. The discussion of whether the presence of pictures facilitate or hinder subjects' recall of prose information that is not pictured is based on the second analysis. _Text-only Test_ score was the dependent variable for the second analysis.

With respect to the first and primary variable of the study (text-redundant information), the analysis indicated that picture effects were present and durable over time (55 days). Subjects who were in the prose-plus-picture condition remembered significantly more information that was presented in the passages and represented in the pictures than those subjects who received the prose-only treatment in both the immediate and delayed (55 days) testing conditions (Text-redundant Test). Both treatment groups' average recall was significantly lower in the delayed testing condition. The results of the analysis provide evidence that picture effects are durable over at least a 55-day delay.

A theoretical explanation of higher recall scores in prose-plus-picture (representational pictures) conditions has been suggested by Levin (1981). Levin argues that representational pictures produce a memory trace which is more robust than that associated with a verbal representation of the text. The more robust trace would have benefits during initial storage of the information in the passage as well as later retrieval of the passage information. Representational pictures make the information in the prose passages more specific and provide a second mode for the information to be represented in the brain (Levin, 1981).

Subjects' average recall in the prose-plus-picture condition was 11% - 15% higher than that of subjects in the prose only-condition. The magnitude of the picture effects in both the immediate and delayed (55 days) testing conditions are similar to those identified by Anglin (in press). Using younger children as subjects, Levin and Berry (1980) and Peng and Levin (1979) also identified similar average picture facilitation which ranged from 13% - 20% higher for prose-plus-picture groups than prose-only groups.

The second variable considered in this study was the potential effect the presence of pictures had on the recall of information presented in prose passages which was not represented in pictures. The presence of pictures facilitated moderately the recall (Text-only Test) of information which was presented only in the prose passage for the immediate testing condition. However, this facilitation was not significantly greater for the prose-plus-picture condition. The second analysis indicated that the presence of pictures did not significantly facilitate or hinder recall of information which was presented only in the prose passage. The average recall of information for subjects in the prose-plus-picture condition did not differ significantly with that of subjects in the prose-only condition. However, subjects' average recall was significantly lower for both treatment groups on the delayed testing condition.

In summary, the limits of the durability of picture effects was extended from 26 days to 55 days. Results of this study also support the claim that the presence of representational pictures in prose passages does not significantly facilitate or hinder the recall of information in prose passages that is not pictured. Further extension of the limits of the durability of picture effects is justified. Are picture effects durable across types of prose passages (narratives, human interest, etc.)? Will the magnitude of picture effects be similar across passage types? Will pictures facilitate the recall of information presented in prose passages for adult learners? Results of this study and knowledge of the effects of passage type and audience would provide practical information for individuals concerned with the design of instruction.

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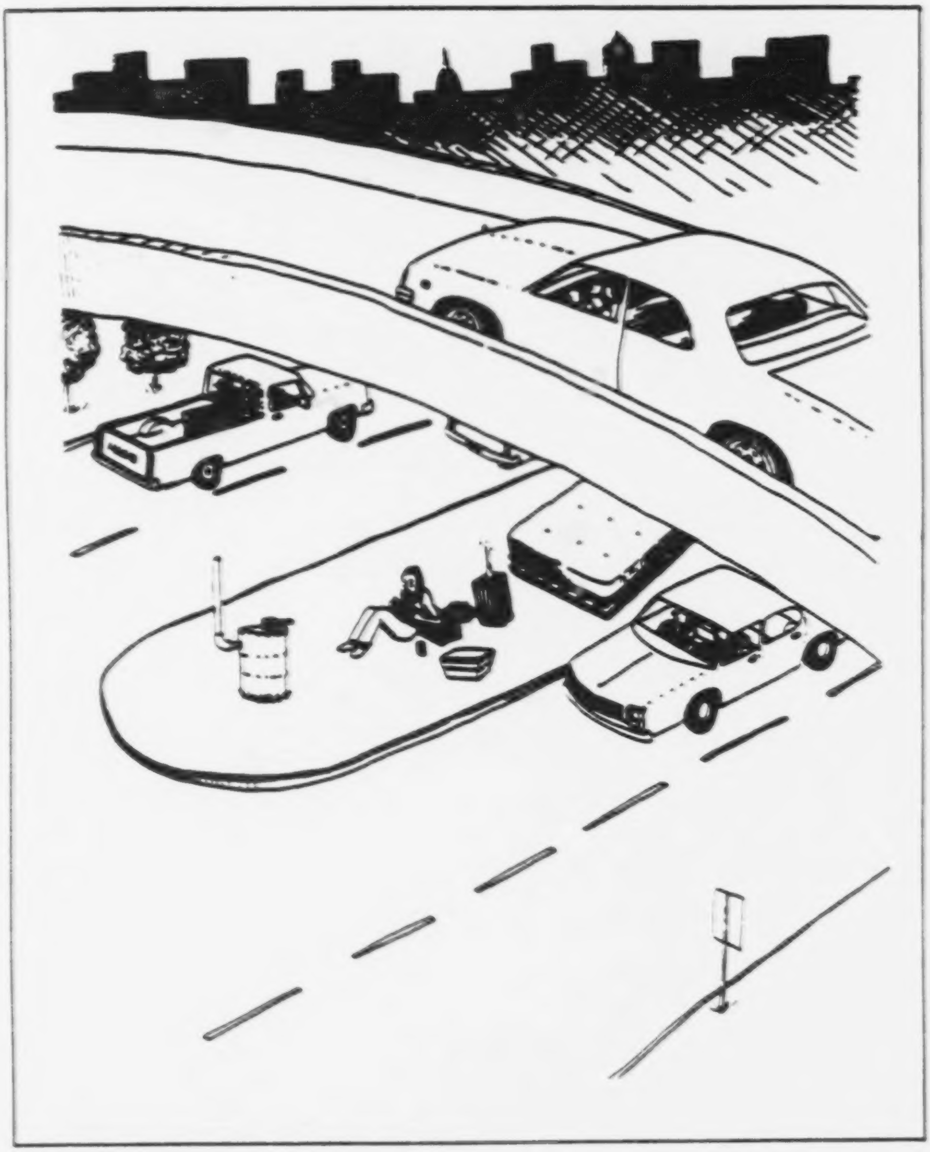
Table 1

Means and Standard Deviations of Subjects' Prose Recall Scores by Treatment, Time of Test and Information Tested.

	Treatment	Immediate		Delayed		Marginals	
		M	*SD*	*M*	*SD*	*M*	*SD*
Text-redundant Test	Prose-plus-picture	13.18	1.75	7.57	3.51	10.38	3.95
	Prose-only	11.53	2.02	5.38	1.82	8.45	3.66
	Marginals	12.30	2.05	6.40	2.91		
Text-only Test	Prose-plus-picture	12.39	1.08	4.43	3.09	8.41	4.65
	Prose-only	11.47	2.13	4.59	2.26	8.03	4.12
	Marginals	11.90	1.76	4.52	2.63		

Note: Prose Recall scores can range from 0 to 15 for both the test measuring text-redundant information and the test measuring information presented in the text only.

Figure 1. Picture Accompanying One of the Prose Passages in Experimental Condition.



THE DISPLAY OF COLOR GRAPHICS ON MONOCHROME MONITORS: A CONCERN FOR DESIGNERS AND AN OPPORTUNITY FOR RESEARCHERS

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ABSTRACT

This paper presents the problem of displaying color graphics on monochrome monitors, design rules for such graphic displays, and current and proposed research to examine the perceptual and cognitive effects of pictures displayed via monochrome monitors. In order to empirically test the usefulness of the proposed design principles, a study was conducted to examine whether children could recognize computer generated pictures on monochrome monitors. Subjects were 64 second, third, and fourth graders who were randomly assigned to one of two conditions. Children in the first treatment were asked to identify, on a monochrome monitor, a figure that was initially presented in its original form and then as a redesigned, more distinguishable figure. The redesigned figure had greater figure/ground contrast because color substitutions were made that utilized pixel patterns to provide contrast in the monochromatic display. The order of picture presentation was reversed for the children in the second treatment. Results indicated that regardless of grade or FI/FD characteristics, children in this study were unable to discern critical features of a color graphic displayed on a monochromatic monitor unless it was designed to enhance figure/ground separation ($p<.0001$). Implications for further research, as suggested by the results of the study, are discussed.

THE DISPLAY OF COLOR GRAPHICS ON MONOCHROME MONITORS: A CONCERN FOR DESIGNERS AND AN OPPORTUNITY FOR RESEARCHERS

The proliferation of microcomputer generated graphics in instructional software forces new attention upon the issues involved in picture comprehension. Visual learning via computer encompasses several elements: the learner's perceptual system, the design of the visual message, and the medium's manner of conveying that message. While designers and producers can feel confident that pictures will usually enhance their messages, they have less information to assist them in determining the characteristics of pictures that make them more or less appropriate for specific audiences. Furthermore, in the case of computer generated pictures, the designer does not have any control over the hardware used for display.

A critical design issue emerges when graphics intended for color display are presented on monochrome monitors or TV receivers. Color graphics that were designed to be appealing and useful to instruction are found to be less than helpful as monochromatic pictures; figure/ground separation that is aided by color differences is lost in monochrome pictures. Shapes are indiscernible and figures blend into the background.

A SOLUTION FOR THE DESIGN OF PICTURES FOR COLOR AND MONOCHROME DISPLAY

By following design rules developed by Baker (1983), it is possible to design computer graphics that are perceptually salient for both monochrome and color display. These rules, developed for Apple II graphics, are outlined in Table I. The rules suggest which colors can be juxtaposed in order to allow for good figure/ground separation. Because of the way monitors translate the display signal to the screen, Apple II colors are presented on a monochromatic monitor in patterns of pixels (lighted dots). By consulting Table I, the designer can choose which colors can be juxtaposed. The designer can utilize the differing pixel patterns to provide contrast and to avoid similar patterns that weaken figure/ground separation.

Insert Table 1 about here

Although these rules apply specifically to Apple II low resolution colors, the principles generally apply to the design of pictures for other computers also. The computer may not translate display signals into pixel patterns, but colors may appear as shades of gray (or whatever the color of display is.) The designer then applies the general rule: in order to make the picture interpretable in either mode, be sure that juxtapositioned colors exhibit contrasting shades of gray in monochrome. Regardless of the computer or the display hardware, the designer is asked to be sensitive to the range of possible display hardware for color graphics in computer courseware.

THE STUDY

The design rules eminated from the practical notion of making color graphics in computer courseware suitable for the many monochrome monitors in use in schools. Yet there was little empirical evidence that following such design rules would result in pictures that were more intelligible to the children who were the intended users of the courseware. Related research was investigated, and a study was designed to empirically test the design rules that were intuitively needed and purposely formulated. This study is reported in detail by Baker, Belland, and Cambre (1985).

Review of Related Research

Several theoretical and applied areas provide insights into the variables affecting picture comprehension. These include perceptual and developmental psychology, message design, and individual differences within cognitive psychology.

Developmentalists and perceptual psychologists identify experience and maturation as important components of visual perception. A number of researchers have found that age interacts with children's ability to extract relevant information from pictures. Children do not interpret pictures in the same manner as adults nor do they obtain as much information (Campbell, 1981). For instance, young children are unable to ignore irrelevant information and are easily distracted from essential cues by peripheral details (Collins, 1970; Dwyer, 1978; Fleming & Levie, 1978). Younger children have been shown to prefer simpler pictures and to be able to extract more relevant information from them than from more complex pictures (Travers & Alvarado, 1970).

Gardner, Wolf & Smith (1975) further observed that young children's diffuse scanning patterns and numerous small eye movements affect their ability to examine a picture holistically. Travers & Alvarado (1970) suggest that children tend to perceive parts before they perceive wholes. Children in the lower elementary grades are therefore likely to have difficulty perceiving and interrelating the various elements of a picture. Older children are better able to perceive and describe an entire scene.

Gibson (1969:77) posits that experience provides essential practice in detection, discrimination, recognition, and identification; "...as perception develops the organism comes to detect properties of stimulation not previously detected even though they may have been present. With growth and continued exposure to the world of stimulation, perception becomes better differentiated and more precise."

In addition to the issues of developmental visual perception, critical features of pictures such as figure/ground are also important to picture comprehension. Figure/ground is so basic a concern in message design that it is usually taken as the starting point of form comprehension. A German researcher named Rubin is credited with the first studies of the features of figure/ground organization in 1921 (cf Haber & Hershenson, 1973:184). He observed that the figure has form or shape, with recognizable "thinglike" qualities, whereas ground is either formless or having weaker or less definite form characteristics. When figure/ground relationships break down, the result is camouflage or lack of meaning.

Contour is a critical element that separates figure from ground, although the contour usually seems to belong to the figure. Information or uncertainty is concentrated along contours or edges. Thus, if the contours are not perceived as edges of the figures, the figures are difficult to see. Hochberg (1962:39) recommends the addition of cues to enhance figure/ground separation and make the edges more discernable; among them are making the figure more realistic or iconic, using pigment or other drawing to simulate shade and shadows, using depth or perspective techniques.

The need for discernible edges of objects is as important in animated pictures as in still pictures. In a discussion of perceptual precepts of animations intended to facilitate learning for children, Caldwell (1978:23) suggests that children 4-8 years old will more readily perceive drawn objects if they are "outlined with obvious, unbroken boundaries than when the boundaries are broken or otherwise indistinct." She further suggests that bright or well-illuminated objects will be discriminated as the figure first.

Dwyer (1978) found that individual differences such as intelligence, reading comprehension, and entry behavior are critical variables in students' ability to learn from different types of pictures. Cognitive style might also be a differentiating variable in children's ability to extract information from pictures. Field independent persons evidence the ability to experience items as discrete from their background and to overcome embeddedness (Ausburn & Ausburn, 1978). Furthermore, the field independent person is likely to seek differentiating information with well distinguished parts, while the field dependent person is more likely to have "fused" experiences, and be unable to separate items of information from their contexts (Guilford, 1980). For the field independent person, sufficient figure/ground separation in a picture becomes even more important.

The Current Study

Perceptual development, message design, and individual differences provided the framework for the present study. A computer-generated picture of a unicorn which was provided as a reward picture in a commercially-developed courseware package was extracted so that it could be displayed independently. In this original version, a critical attribute of unicorns, the singular horn, was barely distinguishable from the the background when displayed on a monochromatic monitor. Another picture was constructed with precisely the same form and content but following Baker's rules. Consulting the table revealed that substitution of two colors was required. The redesigned picture portrayed a unicorn which looked the same as the original picture on a color monitor but had an easily distinguishable horn on a monochromatic monitor. These pictures were displayed on monochromatic monitors to subjects who were asked to describe the content of the pictures. Previous to administering the treatments, the luminescence of the screens was measured and adjusted equally on the monitors so contrast and brightness would not affect results.

Hypotheses

The following hypotheses guided the design and interpretation of the study:

H_1: Subjects will name the main figure in the picture correctly after they experience the redesigned picture. That is, subjects in the first treatment condition will respond correctly on the second trial and subjects in the second treatment condition will respond correctly on the first trial.

H_2: Subjects who experienced the second treatment will be able to name the main figure correctly on both trials.

H_3: Subjects who are field independent will name the main figure correctly more frequently under either treatment condition.

H_4: Subjects from higher grades will name the main figure correctly more frequently under either treatment condition.

Design

Subjects were drawn from the second, third and fourth grade classes of an urban elementary school. Within each grade level, subjects were randomly assigned to one of two treatments. In the first treatment, subjects were shown first the original reward picture on a green-screen (monochrome) monitor and asked to name what they saw. After each subject had made a response, he/she was asked what else was seen. Then the subject was shown the redesigned picture and asked the same questions. In the second treatment, subjects were shown the pictures in the reverse order; the redesigned picture was shown first and the original picture shown second. It was assumed that the identification of the unicorn in least one of the versions indicated that the subject was familiar with the concept "unicorn." Only four of the subjects did not recognize the unicorn in either version.

In another data-gathering session approximately a week later, subjects were administered the Children's Embedded Figures Test (CEFT) in order to assess field independence. There was a total of 64 subjects that were arrayed in the design as shown in Table 2.

Insert Table 2 about here

Results

The data analysis consisted of an multifactor ANOVA using a least squares solution to account for unequal n's. The dependent variable, Recognition, was scored in the following manner: 0 = No recognition of either figure, 1 = Recognition of the redesigned figure, 2 =

Recognition of the original figure, and 3 = Recognition of both figures.

The analysis of variance showed a significant main effect for the treatment variable $F(1,11)=40.27$, $p<.0001$. Subjects in Treatment II ($x=2.59$) recognized the figure more frequently than in Treatment I ($x=1.23$).

There were no significant differences for variables Grade and FI/FD cognitive styles, nor was there any interaction between or among variables.

Insert Table 3 about here

Discussion

As was expected, subjects were able to correctly name the main figure in the picture more often when presented the redesigned form or when presentation of the original picture followed the redesigned form as in the second trial. These results reiterate the need cited by Hochberg (1962:39) to enhance the edges of a figure so it is distinguishable. While figure enhancement has been determined to be important in traditional media, this study shows such figure enhancement to be at least as important with computer generated graphics. Furthermore, the nearly unanimous recognition of the original unicorn after experiencing the redesigned picture supports previous findings that experience and practice increase the ability to extract visual information (Gibson, 1969:77).

The lack of effect from field independence/field dependence may be explained by the notion that this particular type of cognitive style does not take precedence over perceptual development. Cognitive styles remain relatively stable over time and tasks (Ausburn & Ausburn, 1978). On the other hand, the ability to extract visual information improves with experience and maturation. The lack of effect from grade level would seem to negate developmental influence upon picture comprehension. However, a frequency count of the number of times the original unicorn was recognized in Treatment I showed a steadily increasing, yet statistically insignificant, pattern of recognition. Such results encourage a replication of the study with a larger sample that includes higher grade levels in addition to grades two, three, and four.

The data from this study have meaningful application to the design of instructional software that incorporates microcomputer generated graphics. The use of a picture as either a reward or as an exemplar is futile if the student cannot see what was intended to be seen. An earlier pilot study using the same pictures revealed that the redesigned unicorn had more appeal than the "horse", the label given to the original unicorn by the majority of the subjects. Additionally, if critical attributes are embedded in the picture, then that picture serves as a poor example. The student could possibly assimilate erroneous information as well as miss critical informatin.

The producers of microcomputer generated graphics for computer courseware and educators who purchase the software have some evidence via this study that: 1) microcomputer generated graphics intended for color presentation but displayed on monochromatic monitors may not have sufficient figure/ground contrast, 2) insufficient figure/ground contrast may adversely affect picture comprehension, and 3) younger children, at least through fourth grade, seem to lack the necessary perceptual maturity to overcome the effects of poorly discernible figures on a monochromatic green screen. Since producers have no control over the display devices used with software, attention to the solutions for generating graphics for both color and monochrome display would lead to more intelligible pictures for children regardless of the type of monitor used.

Several elements of the study warrant further investigation. If the sample were larger and expanded to include kindergarten through sixth grade, would the very young children not recognize the original unicorn even after they had seen the redesigned picture and would the older children be able to recognize the unicorn more often even when presented with the original picture? In other words, the practice provided by the redesigned unicorn may not be enough cue for the young children to prompt recognition, and the older children's perceptual maturity may be advanced enough that they would not need the exposure of the redesigned picture to recognize the original one. Another question involves the lack of interaction between recognition and cognitive style. Is the inability of field independent subjects to overcome embeddedness a matter of perceptual immaturity as previously discussed or is it perhaps a function of the characteristics of the pictures used? A larger sample may again provide additional clues as would trying different pictures.

Other questions are prompted by the results of the study and deserve consideration by researchers who want to examine the properties of visual perception via computer generated graphics. Some of these questions include:

(1) What are the unique attributes of computer graphics display?
(2) How do these attributes compare to those of traditional media in terms of viewer perception and cognition?
(3) Do the results of the color/black and white studies hold true for computer generated pictures?

The purpose of this study was to investigate the comprehensibility of microcomputer generated color graphics that are displayed on monochromatic monitors. Such comprehensibility appears to be enhanced by attending to the arrangement of elements in the pictures so that figure/ground separation is apparent in either color or monochrome. Regardless of display hardware, pictures included in courseware can be designed to be comprehensible by users, especially young children.

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TABLE 1

Color Choice for Monochromatic Display Using Apple II Microcomputers

Group 1	_Group 2_	_Group 3_	_Group 4_	_Group 5_	_Group 6_
Black	Magenta	Purple	Gray1*	Lt. Blue	White
	Dk. Blue	Md. Blue	Gray2	Pink	
	Dk. Green	Orange		Yellow	
	Brown	Lt. Green		Aqua	

*Gray1 and Gray2 are nearly indiscernible from each other, and are also very close in value to White. Caution should be used in juxtapositioning these three colors.

Note: From "Color Graphics and Monochromatic Display: Are They Compatible?" by P. Baker, 1983, _Educational Technology_, _22_(12), p. 24. Copyright 1983 by Educational Technology Publications, Inc.

TABLE 2

Distribution of Subjects

		I	II*
Grade 2	FI	2	4
	FD	6	6
Grade 3	FI	8	5
	FD	4	8
Grade 4	FI	5	5
	FD	7	4
		n=32	n=32

*Order of graphic presentation

I = Original, redesigned

II = Redesigned, original

Note: From "Recognition of Computer-Generated Pictures on Monochromatic Monitors" by P. Baker, J. Belland, and M. Cambre, 1985, Journal of Computer-Based Instruction, 12(4), p. 105. Copyright 1985 by ADCIS.

TABLE 3

ANOVA of Figure Recognition by Treatment, Grade, and FI/FD Assessment

Source	df	SS	F
Treatment	1	27.5625	40.27*
Grade	2	0.1289	0.09
FI/FD	1	0.4017	0.59
T*G	2	0.4156	0.30
T*FI/FD	1	0.1436	0.21
G*FI/FD	2	0.6505	0.48
T*G*FI/FD	2	0.8601	0.63
Total:	11		

*p<.0001

Note: From "Recognition of Computer-Generated Pictures on Monochromatic Monitors" by P. Baker, J. Belland, and M. Cambre, 1985, *Journal of Computer-Based Instruction*, *12*(4), p. 106. Copyright 1985 by ADCIS.

INSTRUCTIONAL FILM RESEARCH AND THE LEARNER

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INSTRUCTIONAL FILM RESEARCH AND THE LEARNER

Research into the value and effectiveness of motion pictures in education has spanned more than six decades. Most of the work was done prior to 1970, with the middle 1950's representing the peak of activity. Hoban and van Ormer (1970) reviewed the research conducted between 1918 and 1950. Since that time there appears to be no indepth search which focuses entirely on the instructional film. This was due largely to the new interest in instructional television. Of the nearly three hundred and thirty-five studies analyzed by Reid and MacLennan (1967), only thirty percent of them dealt with instructional films, while the other two-thirds were concerned with the effectiveness of instructional television. Other writers such as Allen (1960), Lumsdaine (1963), Twyford (1969), Simonson (1980), and Seibert and Ullmer (1982) compiled definitive findings from the research on communication media in general. Their writings did not focus on work with instructional film in particular.

If one were to look closely at the research on instructional film, three distinct phases in the research become apparent. The first phase emphasizes the capacity and capabilities of film as a medium for teaching groups of learners effectively. These studies, which spanned roughly from the late 1910's to the early 1950's, focused on the film itself and what it could or could not accomplish as an instructional tool. These studies primarily analyzed the capacity of film to teach basic facts and concepts when compared to conventional teaching. A few studies of that period even compared film teaching to teaching with other types of media such as filmstrips and still photographs. Later, research efforts shifted to the manipulation of certain film qualities in an attempt to achieve a given learning outcome. In these studies, conducted primarily during the 1940's and 1950's, researchers experimented with the presence or absence of color, sound effects, music, animation, and narrative structure.

Then, around 1960 the research slowly began to focus on the learner. The research question now became, "Who learns from films?" rather than, "Can films teach?" or "How do films teach?" The two latter questions imply a sort of overt action on the part of the teacher in which something is done to the learner. The first question is more covert in nature. Here, the burden for action is placed on the learner. The first question analyzes what the learner brings to a learning situation, while the other two look at what the teacher brings to an instructional situation. Focus on the learner thus presented researchers with a number of new variables for study. Intelligence, aptitude, learning style, personality variables, maturation, ethnic background, sex, and other individual traits came under study as these traits interacted with the attributes of motion pictures.

Figure 1 depicts the three phases of instructional film research conducted in this country over the past sixty-five years as gleaned from the literature. The illustration should in no way imply distinct breaks in the research efforts, but should be viewed as a continuous and dynamic search, with much overlapping between juxtaposed phases.

INSTRUCTIONAL FILM RESEARCH
1918 - 1985

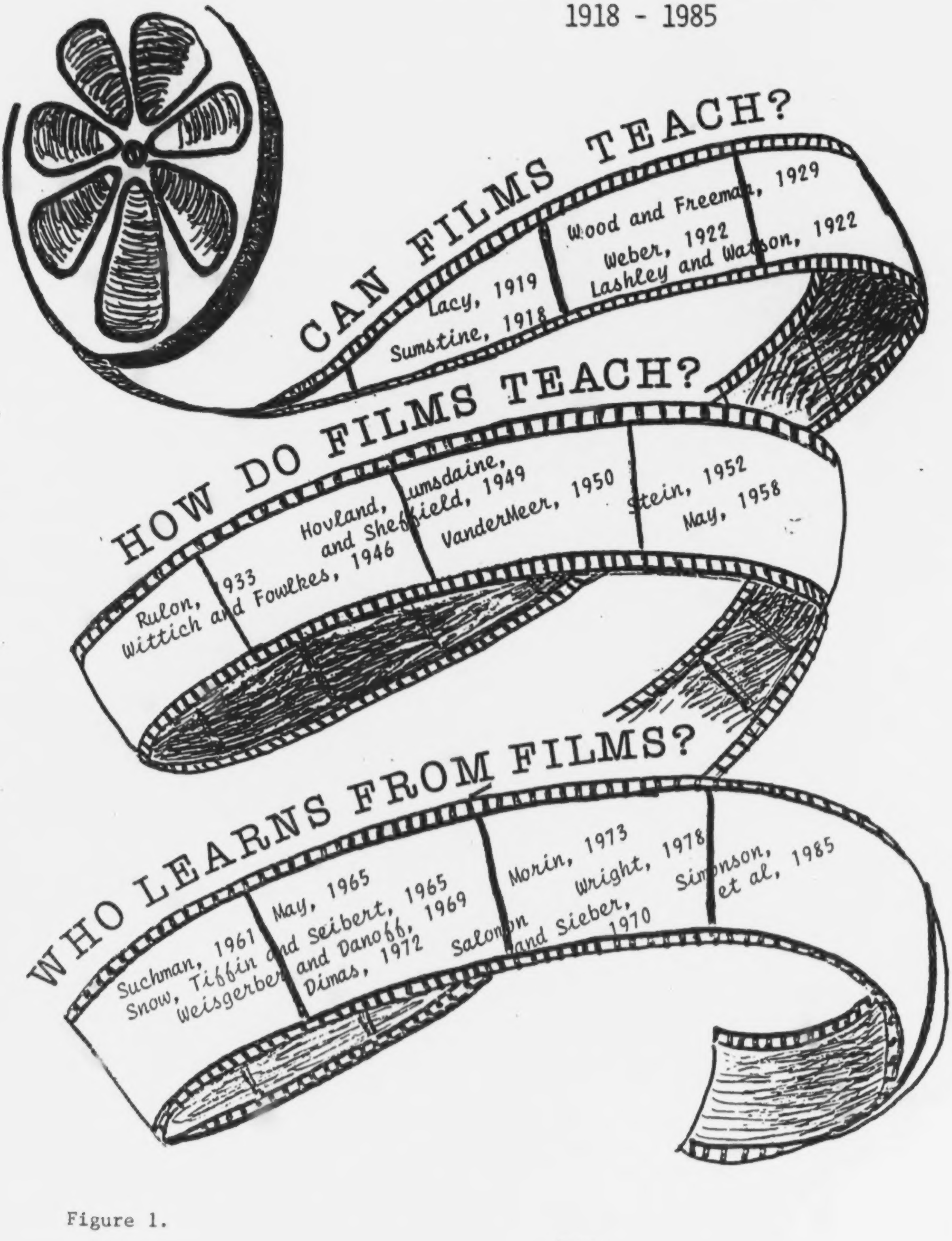
CAN FILMS TEACH?
Sumstine, 1918
Lacy, 1919
Wood and Freeman, 1929
Weber, 1922
Lashley and Watson, 1922
HOW DO FILMS TEACH?
Rulon, 1933
Wittich and Fowlkes, 1946
Hovland, Lumsdaine, and Sheffield, 1949
VanderMeer, 1950
Stein, 1952
May, 1958
WHO LEARNS FROM FILMS?
Suchman, 1961
Snow, Tiffin and Seibert, 1965
Weisgerber and Danoff, 1969
May, 1965
Dimas, 1972
Salomon and Sieber, 1970
Morin, 1973
Wright, 1978
Simonson, et al, 1985

Figure 1.

The present paper concentrates on experimental studies which are representative of the third phase. These studies focus on the the question, "Who learns from film?" They were conducted primarily between 1960 and 1985 as this was the period in which the research interests appear to have shifted from the film to the student. The paper does not, however, focus on all individual differences that were studied, but deals mainly with the development of higher level cognitive skills through the use of films, the effects of film viewing on individual learning styles and other learner differences, and the effects of film viewing on the self-concepts of students. It was reasoned that these findings might be of the most value to teachers as they seek solutions to some of the most challenging problems confronting them in practically every classroom.

Purposes

This paper has four (4) main purposes. (1) It seeks to report the findings from instructional film research which focus on the use of films in helping students to master higher cognitive learning, particularly among the talented and gifted. Higher cognitive learning is concerned with mastery of problem-solving and inquiry skills which include hypothesis generation, the generation of appropriate questions, the development of observation skills, and hypothesis testing and evaluation.

(2) The paper will summarize the available research on the interaction between film viewing and learning styles. While these studies are few in number, they represent a promising approach to a difficult question---"What works for what type of learner?"

(3) The paper seeks to summarize the research findings on the use of films in enhancing the self-concepts of school-age children. The problem of low self-esteem, particularly among minority inner-city students, has long been regarded as an obstacle to academic achievement. Self-concept has also been found to be an important differential in teaching females in science and mathematics classes.

(4) The paper will then discuss implications of the research findings and make recommendations for their applications in a normal classroom. This section emphasizes the fact that the use of films in teaching and learning did not represent a panacea for all of the ills in the classroom, but they did bring a fresh approach and need variety to the scene.

The Effects of Films on Higher-Cognitive Learning

It has generally been accepted that film viewing is an effective and efficient method for helping students to increase their store of basic facts and concepts. It is not enough, however, to simply teach facts in the classroom. Teachers must also help students in learning broad general principles, and in mastering inquiry and problem-solving skills that are so needed in order to function in a complex society. A few experimental studies have attempted to determine the effectiveness of films in helping students to master these types of skills.

The effects of informational-expository and historical-dramatic types of films on student abilities to master the scientific method were studied by Kazem (1960). Four groups of high school students were matched on pre-test knowledge, intelligence, reading ability, sex, age, and school location. One group saw two informational-expository films. A second group saw two historical-dramatic films, and a third group saw one of each type. The control group did not view films. Film groups significantly out-scored the control group on the application of knowledge tests. The group viewing a combination of films made more gains that did the group viewing historical-dramatic films, but the differences were not statistically significant. High ability students made consistently higher scores, but students of average intelligence made the most gains. Test scores between the sexes did not differ.

At the University of Illinois, Suchman (1961) believed that when children reach the operational stage of development, they can be trained in the mastery of inquiry skills. Exposing children to a systematic process of discovery is the key to such training. Drawing on the writings of Jerome Bruner and others, Suchman summarized the benefits of the training (p.151): (a) exploration, manipulation, and mastery are intrinsically motivating; (b) a reinforcing sense of power and self-confidence comes from successful autonomous discovery; and (c) the strategy of data intake and processing has an important effect on the productivity and depth of discovery. The author then described the results of an experimental program called Inquiry Training designed for students in the intermediate grades.

Fifty students of high ability were exposed to science problems using filmed demonstrations. Students were asked to identify objects in the demonstrations, verify conditions and changes in the objects during the demonstrations, and cite variables responsible for the changes. Student responses were recorded on the blackboard. They were then asked to identify conditions that could affect the outcome of the demonstration, such as, "What would happen if...?" Students then had to seek verification as to why the condition would affect the outcome. The author explained the importance of this method (p.162): "He learns that every episode contains objects, that the state of an object at a given time can be described by a set of attendant conditions, and that any change in a condition is an event...The child learns to identify first all objects and systems, and then to determine their conditions both at the beginning of the episode and immediately following each independent event." The films used in the study were organized and presented to expand on previous learning. Each film involved a new concept or a new variation of a previous one. Suchman felt that structuring the films in this manner was important in giving students a sense of progress.

Results of the study were cited in terms of individual progress. Students were observed in the number and types of questions they asked in problem-solving situations after Inquiry Training. Suchman, acknowledging the wide range in individual differences, concluded that this type of training had definite benefits in helping youngsters increase inquiry skills. The method proved particularly helpful with gifted students.

Allender (1968) described three studies using inquiry training with students in grades three through seven. The studies used specially developed films and other materials. As a test of inquiry skills, students were required to role-play a small city mayor. Increases in the desired behaviors directly correlated with increases in grade level, but no interactions were found with sex, intelligence, or reading ability.

Two studies conducted by Salomon and Sieber (1970) described a method for influencing the number of relevant questions and hypotheses generated based on the structure of the stimulus. In the first experiment, two films were used, one with structured sequences, the other with unstructured sequences. Students in one group were asked to write down the number of details observed in the structured film and to generate as many hypotheses as possible about the plot of the unstructured film. It was predicted that the unstructured film would solicit more questions but fewer hypotheses. In the second experiment, subjects were asked to memorize as many details as possible in the film scenes or to generate hypotheses. The dependent measure was the number of times subjects asked to review the film sequences. It was predicted that the number of details and hypotheses reported was directly related to the structure or lack of structure in the stimulus.

Results of the first experiment supported the hypothesis. Unstructured films produced more questions and generated more hypotheses than did structured sequences. The second experiment also produced significant differences between the two types of sequences in favor of the unstructured film. The authors concluded that uncertainty and information searching are maximized when a stimulus suggests many different responses.

A study which continued the efforts of Suchman (1961) and Salomon and Sieber (1970) was done by Wright (1978). The same films used by Suchman were used in this study. Students were assigned to three treatment groups during Phase I of the study. At this time, subjects were shown a film depicting a problem situation and were asked to list as many details and generate as many hypotheses for solutions as possible. Maximums were 75 for the former and 5 for the latter task. Fourteen months later subjects used a new set of films to test long-term retention of the previous training. The study found that students were significantly more successful in demonstrating the types of inquiry skills in which they had receive intensive training. For example, students who had been trained in attending cues to generate details about a problem were able to list a significantly higher number of details in a new problem situation than were students who had not had the training. An important conclusion of the study was that it "presents a model for investigating means of improving basic inquiry skills" (Wright, 1978, p.213). It was also assumed that the development of such skills could conceivably be carried out in the average classroom.

Another study of this type was conducted by Pearson (1972). Here, films were used as verbal mediators with nursing students to help sharpen their observation skills. The author designed the study in order to determine the feasibility of increasing the number of real observations reported by students in a patient-nurse contact and to minimize the number of inferences being reported as real observations. It was hypothesized that students receiving filmed instruction would report more observations and fewer inferences than would students not receiving the films. The study divided 129 students into three treatment groups. Two groups viewed special observation technique films, a preparatory film, and the test film. A third group saw only the preparatory film before the final test film. With the test film, students were asked to: "Please list below all the observation of fact or occurrence that you noticed about the patient in the filmed sequence you just viewed" (p.288). A jury then classified responses as real observation or inference. Using ANOVA techniques, the researcher found that there were significantly fewer inferences reported as observation by the nurses who had learned observing skills with instructional films as compared to nurses who did not see the films.

The studies dealing with the development of higher cognitive skills have been few in number, but represent important work in the effective use of instructional films. Research findings indicate that it is possible through training to increase the ability of students to attend to details, pose relevant questions, and generate hypotheses in a given problem situation. These processes are vital to inquiry, problem-solving, and discovery learning. The research indicates that higher cognitive skills can be developed with the use of films in the very young as well as in adults. At least one study (Allender, 1968), found maturation as a differential in learning hypothesis generation. The research literature, however, presented no studies in which films were used to improve student abilities to test hypotheses, draw conclusions, and evaluate conclusions.

Effects of Films on Learning Styles

A great deal of attention in the instructional film research after 1960 focused on the general aptitude and intelligence levels of students as they interact with filmed materials. Little work, however, has been done with films and learning styles. Hoban and van Ormer (1970) discussed findings from the 1930's and 1940's which suggested that sound films facilitated learning in auditory type learners. May (1965) also discussed the relationship between sensory dominance and learning from media. However, three studies (Thomas, 1972; Smith, 1973; Simonson, et.al., 1985) looked specifically at cognitive styles and film learning, while one study (Snow, Tiffin and Seibert, 1965) tested a broader concept of individual differences and the amount of learning from a film. Two other studies (Salomon, 1972; Clark, 1973) which investigated the effects of aptitude on film learning are included here because of their unique contributions to an understanding of how learners learn with films.

The nature of a film's content on the behavior of young children was found to interact with the cognitive styles of the learners (Thomas, 1972). One hundred and forty-three boys, ages 5 years to 8 years were divided into three groups. One group watched an aggressive film, while a second group saw a nonaggressive film. A control group did not view films. A agression measure after the viewing found that age and cognitive styles were differential in the amount of aggressive behavior observed in the subjects. Younger boys were more aggressive than older boys. Cognitive styles became more differentiated with age.

Don Smith (1973) measured 400 college sociology students for cognitive style using the Rokeach dogmatism scale-Form E. Two groups of 200 each took identical final examinations after one group had been taught with lecture and the other with films. Results of the study indicated no differences in test scores on patterns of cognitive style, GPA, sex, or major field of study. The author pointed out that the study used group effects rather than individual effects in an attempt to replicate group problems usually confronted by the average teacher.

Thus, the results must be interpreted as evidence of the general effectiveness of films in teaching.

Five studies at Iowa State University looked at "learner aptitude interaction with media type when attitude change is the goal of instruction" (Simonson, et.al., 1985, p.4). The studies specifically investigated the characteristics of field dependence (FD), field independence (FI), and hemisphericity as they interacted with mediated messages. Cognitive styles of the participating students were measured using the Embedded Figures Test for FD/FI and the Conjugate Lateral Eye Movement Test for hemisphericity. The studies focused on developing desired student attitudes toward soil conservation, smoking, or disabled persons.

Results of two of the studies indicated an interaction between treatment and cognitive style. Students who had viewed the film on soil conservation and who were field independent had higher attitude scores that did the other treatment groups. Also, students who were field independent and viewed the film on disabled persons were found the have more positive attitudes toward the subject. Left brain dominant students were found to have more positive attitudes toward soil conservation than did right brain dominant students. The authors concluded that motion pictures tended to work generally best for all learners and for field independent learners in particular.

A broader concept of individual differences and learning from film was studied by Snow, Tiffin and Seibert (1965) at Purdue University. Four hundred and thirty-seven college physics students were divided into film group and control group. Students were assessed for the personal variables of ascendancy, responsibility, emotional stability, attitude toward physics, attitude toward film, numerical and verbal aptitude, and prior knowledge of physics. Results of the study indicated that students who were active, self-assured, and independent performed better with film than with face-to-face instruction. On the other hand, students who were low in responsibility and tended to be unwilling to take on independent learning activities preferred conventional teaching. On the intellectual variables, students low in aptitude performed better with the film treatment. The authors speculated that viewing the film allowed low aptitude students an opportunity for needed clarification of physics concepts.

In a discussion of the findings the authors concluded that instructional method can inhibit learning in some students while facilitating learning in others. It was hoped that the study would provide grounds for decisions concerning the assignment of students to alternative instructional treatments.

An explanation for the interaction between aptitude and film viewing that was found in the study above could lie in the findings by Salomon (1972). This researcher found that 8th and 9th ground students internalized and imitated visual codes from motion pictures according to their levels of mathematical and verbal aptitudes. It was hypothesized that students low in aptitude would use visual cues for modeling and internalizing visual information, and that students high in aptitude would already have a useful internalization code and would only need visuals to activate it. Both hypotheses were partially supported. Students high in aptitude tended to notice fewer visual cues in a film which depicted a solid object being unfolded into space. On the visualization test these students were unable to reconstruct the object as well as low aptitude students. It was suggested that low aptitude students did not already have a schematic code to be supplanted as did the high aptitude students, hence the greater attention to visual cues.

Further support for the explanation might also be found in a report by Clark (1973). College students in a psychology class were divided into film and control groups after their scores on the Hidden Figures part of the French Aptitude Test had been obtained. Using ANOVA techniques, the researchers found that low aptitude students performed significantly better with the film than with the teacher.

The film research on learning styles and other learner characteristics suggests that films are more effective with students who are field independent, left brain dominant, high in responsibility, self-assured, and who are low in mathematical and verbal aptitude. Face-to-face instruction tends to work best with passive, irresponsible, and high aptitude students.

The Use of Films in Changing Self-Concepts

It is generally accepted that students will not learn well if they bring to the learning situation negative or low concepts of themselves. Much work in educational research has been undertaken in the last twenty years to help improve student self-esteem. The influence of film viewing on the changing self-concepts of children, particularly among black children who come from low socio-economic homes, has been studied by a number of researchers (Weisgerber and Danoff, 1969; Teaham, 1969; Dimas, 1970; Morin, 1973, 1976). At least one study (Paroly, 1983) looked at the stereotyping of female social roles in films designed for elementary school children.

The study by Weisgerber and Danoff (1969) used a mixed group of black and white students to test changes in attitudes toward a black hero (Frederick Douglass). It also sought to discover if the film had any effect on the self-image of the black students. Two experimental groups viewed the film, while two control groups did not. Eight self-concept instruments were administered prior to the film and three days following the film. Responses were analyzed according to race, sex, and socio-economic status. The results showed that both control and treatment groups identified equally with the hero. One has to speculate about the researchers' choice of a film hero since Frederick Douglass is so well-known and accepted by most school-age youngsters. Surprisingly, the study did find differences on the variable of sex. Black females possessed more self-esteem than black males, while white males possessed more self-esteem than did white females.

In that same year, Teaham (1969) conducted further research dealing with the impact of film on the self-concepts of minority children. Teaham hypothesized that the viewing of films about successful black professionals would improve the self-concepts of black youth and would raise their levels of aspiration. Students in the study came from five inner city schools in a large midwestern city. One experimental group saw six films about black professionals and six films showing white professionals. A second experimental group saw six films, all showing black professionals. A control group saw no films. Attitude instruments were given one month prior to the film showings and one month after the films.

Students who saw the films changed significantly in their attitudes toward their own race and toward themselves. Students who only saw films with black professionals made the most significant changes. The latter finding was particularly true for black males from low socio-economic homes. Students in the control group moved in the opposite direction, showing less racial and self-pride over time. The study also found that black girls tended to have lower goal aspirations than did the boys.

A similar study by Dimas (1970) divided fourth and sixth grade black students into two groups. One group viewed films about black heroes such as Jackie Robinson and Martin Luther King, Jr. They also saw film segments of a black middle class family. A second group saw similar films, but these films portrayed white models. The study found that students who viewed the films with black role models later expressed more positive aspects of self-concept than did students who viewed films with white role models.

The findings in the Teahan and Dimas studies were not replicated by Morin (1973, 1976). This study sought to measure attitude changes of black students when exposed to a film with either black or white actors. It was assumed that the race of the communicator in a film would affect the attitudes of black students toward that film differently, particularly when the students were stratified by socio-economic status. It was believed that students from high socio-economic homes would identify more readily with white actors and that the opposite would be true for students from low socio-economic homes. The hypothesis was rejected. There were no changes in attitudes among either group toward the films. Morin concluded that black children were not overly preoccupied with the race of the film communicator, therefore the race of the film actor does not significantly affect the attitudes of minority children.

Paroly (1983) wondered about the effects of educational films on the self-concepts of female children. Analyzing the degree of female stereotyping in 32 films produced for elementary school children between 1975 and 1980, the investigator found that male and female roles were not equal in portraying occupational or vocational behaviors. Males were more often portrayed in achievement or leadership roles, while females were more often portrayed in nurturing or submissive roles. The Paroly study suggests that because young children tend to accept the "authority" of films in a learning situation, the use of certain films may work adversely in efforts to form positive self-concepts among children.

While one study found no interaction between the self-concepts of minority children and film role models, most of the evidence supports the presence of such an interaction. Films have been found to foster racial pride among minority students and to postively influence the way these students think of themselves. Other evidence suggests the presence of sex biases in many instructional films which are currently being used in elementary schools. Teachers are subsequently urged to become aware of these films and their potential negative effects on the self-concepts of female children.

Conclusions and Implications

Instructional film research which focused more closely on the learner has provided the classroom practitioner with important clues to differences in learner characteristics and how these differences affect learning under various conditions. While the number of studies of this type has been disappointing, the work that has been done is of tremendous value to teachers as they seek effective methods of instruction for all types of students. The popular acceptance of film as a teaching and learning tool coupled with the fact that most schools have ready access to some kind of film collection, increases the value of the film research literature as a source of possible answers to some difficult questions.

The following conclusions and implications are drawn from the film research literature:

1. Films are effective in teaching students the skills of inquiry learning, discovery, and problem-solving. Teachers who work with gifted and talented students should consider the frequent use of appropriately-designed films.

2. Unstructured films have been found to generate more relevant questions and more hypotheses in problem-solving activities than structured films. When these higher-cognitive activities are a goal of instruction, teachers should seek out and use unstructured films.

3. Films have been found to be particularly effective in teaching observation skills and in training students to attend to important details. Teachers should consider the use of films for needed training prior to assigning tasks which will require the use of these skills.

4. Students who are high in mathematical and verbal aptitudes tend to benefit less from visual cues in films, while students with low aptitudes tend to imitate and internalize such cues. Teachers should, therefore provide students who are poor in mathematical and verbal ability with frequent opportunities to take advantage of film viewing.

5. Films tend to be more effective with students who are influenced by internal forces (field independent), are logical and analytical (left brain dominant), are independent, active, and are high in personal responsibility. Teachers are thus cautioned against the consistent use of films with students who are passive, irresponsible, and who tend to be more influenced by external forces (field dependent).

6. Films have been found to positively influence student self-concepts. Teachers should consider the frequent use of films depicting appropriate role models for deprived minority youngsters when working with this type of student.

7. At least one study found the stereotyping of sex roles in films for young children. Teachers should, therefore, become aware of such biases and should closely preview all films before using, particularly with very young children.

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EXTERNAL PACING AS AN INSTRUCTIONAL STRATEGY FOR THE DESIGN OF MICRO-COMPUTER BASED INSTRUCTIONAL PROGRAMS TO IMPROVE PERFORMANCE ON HIGHER LEVEL INSTRUCTIONAL OBJECTIVES

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Rationale

At the 1985 AECT Convention in Anaheim, CA, the authors presented a research study titled, "Varied Self-Paced Micro-Computer Based Instructional Programs for Addressing Individual Differences When Acquiring Different Levels of Instructional Objectives". A refined version of this study was later accepted for publication in a special issue of ECTJ dealing with micro-computer based instruction and individual learning differences. The *1985 AECT RTD paper presented some unique results regarding the design of micro-computer instructional programs. These results tend to be in opposition to past instructional systems designed to address the problem of individual learning differences by the use of a self-paced instructional method. However, the 1985 AECT RTD paper results were consistent with current cognitive psychology principles, indicating that attending and motivation are strong predictors of successful learning when dealing with improving information processing. In other words, what Wittrock (1978) and others (Yerkes-Dodson Law in Travers, 1972; Zeigarnick Effect and Ovsiankina Effect in DeCecco, 1963) have indicated is that by increasing motivation and attention, learning or information processing may also be increased. On the other hand, what self-paced instructional systems (i.e., Skinner's programmed learning; Glaser's IPI-system; and Postlethwait's Audio-Tutorial System; in Cross 1976) tend to do is put the locus of control for pacing in the learner's hands. This would tend to decrease external control, not only for pacing, but also decrease control over the manipulation of the student's attending behavior and motivating the student. A similar position has been expressed by Carrier (1984) and Reiser (1984), both noting that learner's may not be the best judges of what instruction they need, how much instruction, when to seek instruction, and what to attend to in an instructional segment.

The results of the 1985 AECT RTD paper clearly indicated that a micro-computer based instructional program, that is moderately externally paced, allowed for more information to be acquired, and for better performance on higher level objectives, than both self-paced and a more aggressive externally-paced condition. Our results fit the cognitive psychology literature quite well, but were in opposition to the research on self-paced instruction. However, little

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*pp. 146-163 of the 1985 AECT RTD Proceedings, Authors Dwyer, F., Taylor, W., Canelos, J., Belland, J., Baker, P.

research has been done to date on the issue of self-paced instruction and micro-computers, probably because of the widely held erroneous assumption that self pacing is the best way to design micro-computer based instructional programs.

As can be seen in the results of our 1985 AECT RTD paper, summarized in the table of means, Table 6, the external paced plus cognitive processing time condition was superior to both the self-paced and the external-paced, no cognitive processing time conditions. These results are particularly significant when considering that the subject's performance in the external paced plus cognitive processing time condition held constant, even though intellectual task difficulty increased significantly going down the table. Table 7 provides a summary of the analysis of variance results of the 1985 AECT RTD study.

Given the unique results of the 1985 AECT RTD study, and their significance in predicting how to design micro-computer based instruction, the authors have decided to conduct a series of studies to further investigate these results. Since the external control of pacing had such a significant effect on learning, by manipulating attention and motivation, it is likely that further external controls can have an effect upon learning or information processing. These external controls should be designed to control attending behavior and motivation when interacting with visual and verbal information from the micro-computer based instructional program. Looking at the table of means in Table 6 indicates two distinct effects occurring. First the spatial problem free-recall scores are quite low when compared to the other test scores. This even occurred in the Externally Paced plus Cognitive Processing Time Condition. This low score probably occurred because subjects were attending to mostly verbal information and not the spatial or visual information required to solve the spatial free recall problem. As indicated in the 1985 AECT RTD paper, the instructional sequence presented the subject with a visual and a set of verbal information. Each instructional question then required the subject to respond with verbal information. However, visual/spatial information was a part of this to-be-acquired information, but the learner was not directly forced to attend to this information. To externally control this attending to visual information, the instructional program was changed to include a 5 second time delay after the visual was presented, but prior to any verbal information being presented. The presence of visual/spatial information, and the absence of verbal information should presumably direct the learner's attention to the visual information. To further control the learning of spatial information, every 5 to 7 instructional displays the learner was given a cue to try to form a mental image of the visual/spatial information seen so far. This was done by including a special instructional display that formed an outline of the heart, with verbal directions that asked the learner to try to fill in the parts he or she had already seen by forming a mental image. The second effect noted in Table 6 is the wide range of scores across the test types in the Self-Paced and External Paced No Cognitive Processing Condition. It was felt that the 5 second visual delay variable would tend to level off these scores by forcing subjects to more carefully attend to information presented. While these external manipulations of a 5 second visual delay and a cue to image, seem like a small amount of external control, recall that a 7 second delay caused the differences in scores between the Ep + Cp, Sp and Ep - Cp conditions the 1985 study. As indicated in the 1985 AECT RTD paper, cognitive style variables should be examined in terms of effects upon learning when different micro-computer based instructional conditions are used. The cognitive style variable examined in this study was reflectivity and impulsivity. A final variable examined was the effect upon learning of a simple imagery strategy to further control information processing. The four theoretical hypothesis examined in this study were:

1) The external control of a 5 second visual delay will improve overall learning from the instructional programs and particularly the processing of visual and spatial information, for use on spatial learning tasks.

2) A cue to form an image will improve learning on spatial tasks when compared to those subjects without imaging cues.

3) Reflectives will tend to respond more favorably to micro-computer instructional programs than impulsive cognitive styles who probably require more external control than CAI can afford.

4) Imaging training will improve visual learning overall if given prior to working with CAI.

Experimental Design

The present study is a research in progress and was completed on November 8 and 9, 1985, at Ohio State University. The data analysis completed to date appears in Tables 1 thru 5, and Figure 1. This analysis can be compared to the results of the 1985 AECT RTD study found in Tables 6 and 7. Further analysis will be done with the resulting data, and the reflectivity-impulsivity data will be added to this further analysis in addition to a more comprehensive literature review on this cognitive variable. Further, a complete description of the instructional programs and test types/intellectual tasks will be not included in this review but can be found in the 1985 AECT RTD paper, pp. 146-163. However, modifications in those micro-computer based instructional programs will be considered.

The experimental design appears in Figure 2, and is a (4 x 5 x 2 x 2) design. There are 4 basic instructional conditions, as indicated earlier, a 5 second visual delay was added to each instructional condition to improve attending to visual information. The instructional programs are the same used in the 1985 AECT RTD study. However, the external paced no cognitive processing time condition is not used in this study. The programs are micro-computer instructional programs designed to teach the names of the parts of the heart, the heart phases and operations. There are 57 instructional frames in each instructional program, and these are identical to the 1985 AECT RTD study programs. The only overall change in each instructional condition was the addition of the 5 second visual delay, this delay occurs in the following manner. Each instructional display consists of a visual of the heart and relevant heart parts and verbal labels, then under the visual a segment of verbal information appears describing the visual and verbal labels. This information is then removed from the CRT screen, a study question appears, and the learner types in the appropriate answer. To force the learner to attend more carefully to the visual information, a 5 second visual delay occurs after the heart visual and part labels appear on the screen, prior to any verbal instruction appearing under the visual. At this point, the learner is forced to attend to the visual information. After several frames the learner seems to realize that this visual information must be important. Two of the instructional conditions provided an imaging cue, that helped the learner recall prior visual information during the instructional sequence. This imaging cue occurred every 5 to 7 instructional displays in the sequence of 57 displays. The image cues consisted of an outline visual of the heart appearing on the screen, then a verbal segment told the learner to try to fill in the outline drawing with heart parts he or she had already seen by forming an image in the mind. The learner had as much time as needed to think about this image. The 4 basic instructional programs were the:

(1) Self-Paced Instruction - 5 sec. delay - no imaging cue

(2) Self-Paced Instruction - 5 sec. delay - imaging cue
(3) External-Paced Instruction - 5 sec. delay - no imaging cue
(4) External-Paced Instruction - 5 sec. delay - imaging cue

There were 5 types of tests or intellectual tasks. These tests were identical to those given in the 1985 AECT RTD study and are described in detail in that study. The tests represent specific intellectual tasks, and were designed to range in difficulty from a simple task to a difficult task and were called:

(1) List learning test Less Difficult
(2) Spatial learning test, cued recall
(3) Simple concept learning test
(4) Complex concept learning test
(5) Spatial problem test, free recall
More Difficult

The cognitive variable was the reflectivity versus impulsivity variable. As the name implies, the reflective cognitive style tends to take more time with information based decisions, while the impulsive cognitive style tends to have as the main goal; "getting things done quickly." reflectivity-impulsivity was determined using Barratt's test, (Barratt and Patton, 1983). The test was given on-line to subjects prior to beginning the instructional programs, and scores were recorded for each subject. While the reflectivity-impulsivity variable data has been collected, the data has not yet been added to the currently analyzed data. It was assumed that reflectives may be more adept at using micro-computer based instruction than impulsives, indicating that the impulsive cognitive style may need more external control in the learning environment than typical methods of CAI can provide.

The last variable examined was the imagery training variable. It is likely that training subjects to form images would help them acquire visual information better, than no such prior training. The image training group had a brief workshop on how to form mental images by hearing an explanation of the value of imagery in learning, and practicing forming images of objects. The workshop consisted of a video-taped demonstration and explanation of an imagery strategy.

Subjects participating in the study were 200 freshmen from Ohio State University. Subjects received points toward their final grade in freshmen psychology for participation. Subjects were randomly assigned to the 4 instructional conditions, and from there randomly assigned to the imagery training and no training groups. Subjects were run through the study conditions over a period of two days. Data was calculated on 168 subjects who completed the study, yielding an equal 42 subjects in each of the 4 instructional conditions.

Preliminary Analysis and Results

The analysis was conducted using a 4 x 5 x 2 analysis of variance with repeated measures. A complete analysis using the reflectivity-impulsivity variable will be conducted at a later time, and this will yield the complete 4 x 5 x 2 x 2 experimental design found in Figure 2. A table of means for the overall experimental design can be found in Table 1.

The analysis of variance is summerized in Table 4. Table 4 indicates that the significant differences found last year (see Table 7) on the instructional type condition have been eliminated. Looking at the pattern of means found in Table 2 indicates that the differences across test conditions have been leveled off to enough of an extent to eliminate a significant difference on the instructional conditions. In other words, in a general sense, the Self-Paced and External-Paced instructional conditions provided for similar test performance. It should be noted that the External-Paced condition in the present study is the External-Paced plus Cognitive Processing Condition from the 1985 study, the External Paced No Cognitive Processing condition was not used. It is likely that this overall improvement in test performance over last years study was a result of adding the 5 second visual delay to each of the instructional conditions. This visual delay forced the subject to concentrate on the visual display of the heart and labels, thus improving overall information processing. Comparing Table 6 and Table 2, emphasizes this overall performance difference between the 1985 AECT RTD study and the present study. Looking at Table 6 and Table 2 also reveals the significant increase in scores on the Spatial Learning Problem test in the present study. Note that the average score on this test in the present study was 9.71 points, compared to 6.55 points in the 1985 AECT RTD study. It is likely that the 5 second visual delay caused the learner to attend more carefully to visual/spatial information, thus improving scores on the Spatial Learning Problem Test.

Significant differences are found between test types, or intellectual tasks (Table 4). These differences are further analyzed in Table 5, and the results indicate that the tests do range in difficulty, making the spatial learning problem free recall, the most difficult task.

Of particular interest is the interaction found in Table 4 between test type and instructional condition. This interaction is displayed in Figure 1, and the means involved in this interaction are presented in Table 2. A Tukey method has been conducted on the means involved in this significant interaction. The complete analysis of these means will not be presented here, however, the source of the interaction was the different pattern of means occurring in the External-Paced Image Cue condition. The scores in this condition tended to be higher than the other three conditions, particularly the score on the Spatial Problem Free Recall (see Figure 1). Similarly, the Self-Paced Image Cue condition yielded a higher score on the Spatial Problem Free Recall Test, contributing to this interaction. Further analysis of this interaction is planned in a future presentation of the results of this study.

Conclusions

The preliminary results of this study indicate that external control of instructional conditions, in micro-computer based instruction, can improve information processing. These results further support the notion that putting the learner in complete control of instruction, via a self-paced condition, may not be the best teaching method for CAI. Specifically, these preliminary results supported our first hypothesis, indicating that a 5 second delay after visual information is presented on the CRT can improve learning of visual and spatial information. This 5 second delay probably caused the learner to attend more carefully to visual information and therefore process more visual information. While a 5 second delay seems slight, it did improve scores on the Spatial Problem free recall test over the 1985 AECT RTD study, and tended to improve test scores in general. Additionally, support was found for the second hypothesis, indicating that a cue to form images, as a form of external control, improved performance on the Spatial Learning Problem. Students may need this type of cueing to help them process information and tell them what is important and needs to be acquired in the instructional sequence. The imagery training probably did not have a noticeable effect because of the beneficial effects of the 5 second delay and image cueing.

Overall, the External-Paced condition plus cognitive processing time (from the 1985 AECT RTD study) with an imaging cue, was the better of the three micro-computer based instructional conditions. Further analysis is planned by adding the reflectivity-impulsivity variable, and further analysis of the instruction by test interaction will be carried out in a future study presenting this data.

	Self-Paced 5 sec Delay (No Image Cue)		Self-Paced 5 sec. Delay (Image Cue)		External-Paced 5 sec. Delay (No Image Cue)		External-Paced 5 sec. Delay (Image Cue)		$\overline{X}$ 1-5
	Image Trained	Not Trained	Image Trained	Not Trained	Image Trained	Not Trained	Image Trained	Not Trained	
List Learning Test	11.81	10.67	13.10	14.48	11.86	13.67	15.0	12.86	12.93
Spatial Learning Test	13.38	12.86	12.10	14.48	12.71	14.67	14.14	14.33	13.69
Simple Concept	11.91	11.81	11.29	12.33	11.52	12.86	11.67	13.33	12.09
Complex Concept Test	11.91	11.14	10.86	11.67	11.86	11.91	11.76	12.48	11.70
Spatial Problem Free Recall	9.19	8.10	10.29	10.52	9.43	9.67	10.71	9.76	9.71
$\overline{X}$...IT/NIT	11.64	10.91	11.70	12.70	11.48	12.55	12.66	12.55	
$\overline{X}$...SP/EP	11.28		12.20		12.01		12.61		
	Image Training $\overline{X}$.... = 11.87				No Image Training X... = 12.18				

Table 1: Overall Table of Means

Instruction Condition Learning Task	Self-Paced No-Image Cue	Self-Paced Image Cue	External-Paced No-Image Cue	External-Paced Image Cue
1) List Learn	11.24	13.79	12.76	13.93
2) Spatial Cued	13.12	13.71	13.69	14.24
3) Simple Concept	11.86	11.81	12.19	12.50
4) Complex Concept	11.52	11.26	11.88	12.11
5) Spatial Free	8.64	10.41	9.55	10.24

Table 2: Instructional Condition X Test-Learning Task Interaction Means

	Image Training	No Image Training
List Learn	12.94	12.91
Spatial Cued	13.30	14.08
Simple Concept	11.60	12.58
Complex Concept	11.60	11.80
Spatial Free	9.91	9.51

Table 3: Learning Task X Image Type "Almost Interaction" Means

Source (BG)	Mean Sq.	Df	F-Ratio	Probability
Instruction Type (A)	64.814	3	1.092	.35
Image Type (B)	20.430	1	0.344	.56
(A) x (B)	40.321	3	0.679	.57
Error	59.372	160	---	---
(WG)				
Test Type (C)	380.909	4	63.258	.0001
(A) x (C)	11.503	12	1.910	.03
(B) x (C)	13.683	4	2.272	.06
(A) x (B) x (C)	7.417	12	1.232	.26
Error	6.022	640	---	---

Table 4: Analysis of Variance Results; 2 x 4 x 5 Design

(1)	List Learning Test	12.93
(2)	Spatial Learning Cued Test	13.69
(3)	Simple Concept Learning Test	12.09
(4)	Comples Concept Learning Test	11.07
(5)	Spatial Learning Problem Test	9.71

12.93 - 13.69 = .76

12.93 - 12.09 = .84

12.93 - 11.07 = 1.86

12.93 - 9.71 = 3.22*

13.69 - 12.09 = 1.6

13.69 - 11.07 = 2.62*

13.69 - 9.71 = 3.98*

12.09 - 11.07 = 1.02

12.09 - 9.71 = 2.38*

11.07 - 9.71 = 1.36

(*Significant at .05 alpha)

Table 5: Mean Differences, Test Type or Learning Task, Using T-Method

	Self-Paced	External Pace, Norm Reading Speed + Cp	External Pace No Cp	Control	WG, X... Control In
List Learning	12.36	12.48	11.84	1.92	9.65
Spatial Learning Cued	12.32	13.60	10.64	5.68	10.56
Simple Concept Test	11.00	12.80	8.88	7.12	9.95
Complex Concept Test	10.40	13.64	9.48	6.56	10.02
Spatial Problem Free-Recall	6.76	8.60	4.28	.88	5.13
BG, X...	10.67	12.22	9.02	4.43	
Avg. Time Overall	50.36 min.	44.64 min.	45.04 min.	n/a	

Table 6: Resulting Test Means and Overall Time for Each Instructional Program, 1985 AECT - RTD Study

Source	Mean Sq.	Df	f-ratio	Probability
BETWEEN GROUPS				
Instruction/ Pacing (A)	1404.359	3	45.875	.001
Error	30.613	96	---	
WITHIN GROUPS				
Learning Task, Test (B)	493.917	4	99.785	.001
(A) x (B)	51.901	12	10.485	.001
Error	4.949	384	---	

Table 7: Resulting Lindquist I, 4 x 5
Analysis of Variance Data, 1985 AECT - RTD Study

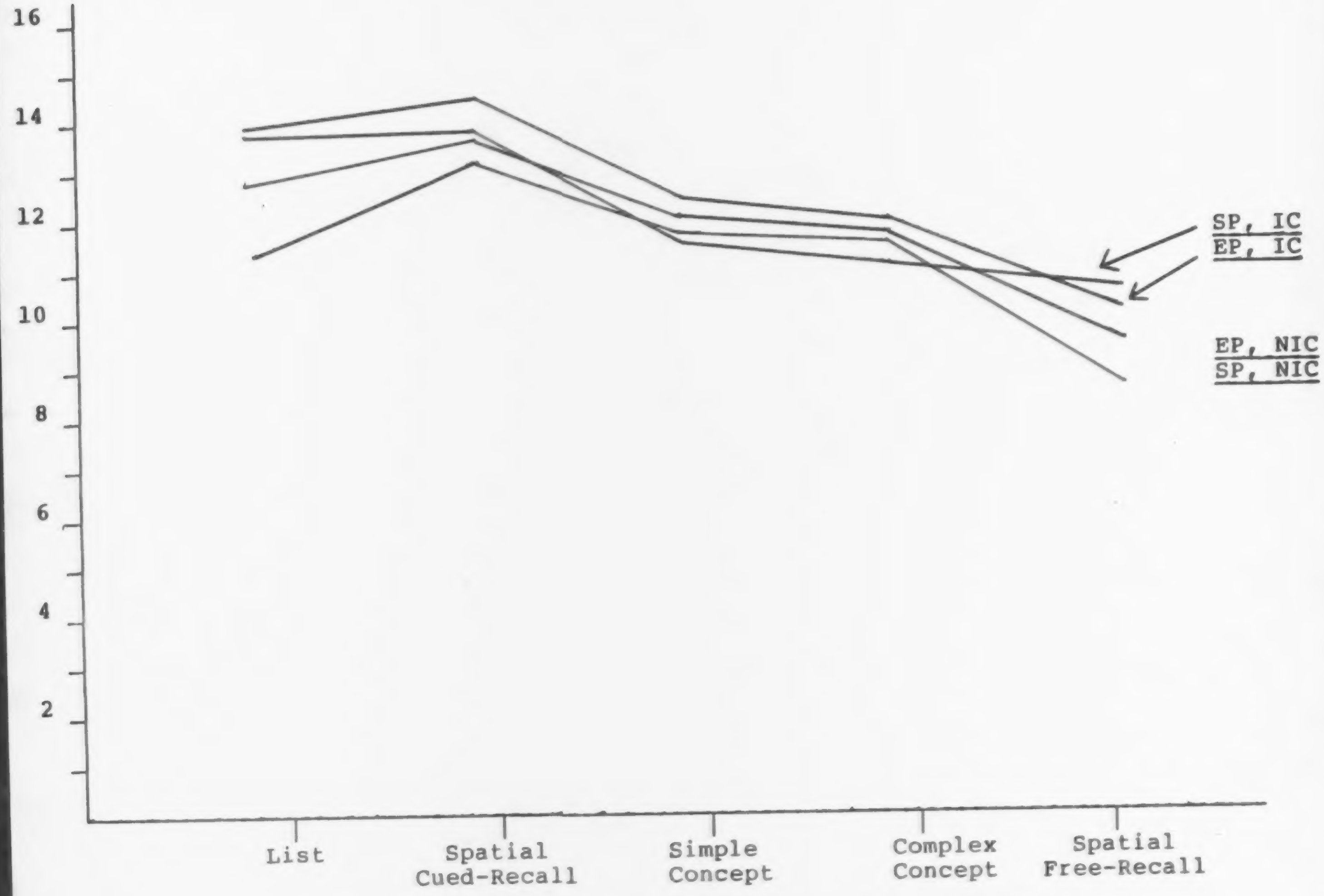

Figure 1: Graphic of Interaction; Instructional Condition x Test Type

SP, IC = Self-Paced, Image Cue
SP, NIC = Self-Paced, No Image Cue
EP, IC = External-Paced, Image Cue
EP, NIC = External-Paced, No Image Cue

	Self-Paced Instruction 5 sec. Delay No Image Cue		Self-Paced Instruction 5 sec. Delay Image Cue		External-Paced Instruction 5 sec. Delay No Image Cue		External-Paced Instruction 5 sec. Delay Image Cue	
	Image Trained	Not Trained	Image Trained	Not Trained	Image Trained	Not Trained	Image Trained	Not Trained
List Learning Test	Ref*	R	R	R	R	R	R	R
	Imp*	I	I	I	I	I	I	I
Spatial Learning Test								
Simple Concept Test								
Complex Concept Test								
Spatial Problem Free Recall								

*Cognitive Variable - Reflectivity vs. Impulsivity not yet analyzed for this write-up

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Figure 2: Complete Experimental Design; 2 x 2 x 4 x 5 Analysis of Variance

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AN ASSESSMENT OF NURSING ATTITUDES TOWARD COMPUTERS IN HEALTH CARE

by

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AN ASSESSMENT OF NURSING ATTITUDES TOWARD COMPUTERS IN HEALTH CARE

PURPOSE OF STUDY

Computer technology is rapidly becoming a part of health care, and one of the primary groups to be affected by computer automation is nursing. Many opinions have been expressed in the literature--some authors suggest ways to facilitate nurses' acceptance of this innovation, while others speculate that the "human oriented" profession will not accept the idea of computer technology. Most of these points of view have not been supported by empirical data. The primary focus of this study is to assess the attitudes of practicing nurses, nursing faculty and nursing students toward the use of computers in the health care setting.

REVIEW OF LITERATURE

Nursing professionals have been writing about computer technology since the early sixties, with a significant number of articles written on the subject beginning in the mid-seventies. Even today, however, nursing journals do not publish a great deal on the subject--some journals dedicate only two articles per year to the topic of computers in nursing and health care (Grobe, 1985). The majority of the literature deals with five main areas of computer usage in relation to nursing and health care: 1) client data gathering functions, 2) educational applications, 3) administrative/management uses, 4) clinical practice applications, and 5) research functions. (See the bibliography for citations concerning each of these areas). These are, of course, important topics of study; however, few nursing research studies deal with questions regarding the potential implications for users of automation in health care--the human factors.

Schwartz (1984) identifies human factors, which are perceptual and attitudinal in nature, that can be categorized as follows: 1) apprehension/confidence level, 2) perception of usefulness of technology, and 3) user motivation. Throughout the nursing literature may be found "opinion articles" that discuss these human factors in terms of how nursing should approach the introduction of computer technology into health care, or that offer predictions of how nurses will respond to the computerization process. These articles approach the subject from an experiential basis--the opinions are rarely based upon empirical data. The following examples are typical of most "human factors" literature in nursing (Anderson, 1984; Zielstroff, 1976; Tate, 1975; Waterstradt, 1981):

a) Careful planning is essential when implementing change; ownership of the computerization plan will facilite acceptance.

b) Open lines of communications must be maintained.

c) A sense of urgency and commitment must be conveyed to facilitate automation by maintaining a forward momentum.

d) Group work is essential in developing a sense of ownership regarding the adoption of automation.

e) A formalized orientation program must be planned and offered for all nursing staff members and for new employees.

Another area of the literature concentrates on more abstract and theoretical aspects, such as conflict that occurs with change of any kind and strategies that aid in coping with these changes. Tate (1975) cites three types of conflict that can occur with computer automation--those that: 1) stem from differing goals and incompatible perceptions/values/beliefs, 2) reflect struggles regarding the allocation of resources such as funding, equipment, power, status, and 3) relate to perceived threats to one's identity as part of a group. Tate's suggested strategies for coping with changes related to computerization are useful for both the individual staff nurse and the nurse administrator. The recommended strategy includes collecting the facts, understanding the nature and dynamics of the system, developing assertiveness skills and strategies, confronting the issue, compromising and negotiating resolution, and finally, "refreezing"--dealing with relationships that have been strained in the process.

Mixed predictions and reviews are found regarding the responses of nurses to computer automation. Frank (1964) speaks of depersonalization and other dangers that the "technotronic" age can bring, while reassuring the reader that nurses need not be fearful of being replaced by computers. Another author deals with "computer cowardice" among nurses and offers educational solutions to miminize the effect (Grobe, 1984). Two of the few empirical studies on nursing attitudes toward computerizaton in health care present a very different point of view. Norwood, Hawkins and Gall (1976) found that 94% of their respondents indicated a favorable view regarding the use of computers in health care. Krampf and Robinson (1984) reported the following attitudes of nurses toward computers: 79.5% feel that they will gain satisfaction from learning to use a computer, 90.4% believe that if nursing informaton is automated nursing productivity and effectiveness will be increased, and 87.7% indicated a willingness to attend staff development programs on computers.

A review of the literature regarding how nurses will respond to computerization or how nursing leaders should introduce the computer automation process in health care settings shows a wealth of personal opinions and personal experiences, but a dearth of quantifiable data. Little empirical information is available that compares perceptions and attitudes toward computerization; that which does exist evaluates primarily the practicing nurse and does not address the attitudes of nursing students and faculty. One primary goal of the present study is to assess the attitudes and perceptions of practicing nurses, student nurses, and nurse educators toward computerization of health care in general, and its impact on the profession of nursing in particular. The following research questions were formulated:

1) What is the perceived value of computers in health care?
2) What is the perceived effect of computer automation on nursing practice?
3) What are nurses' attitudes toward learning about computers?
4) What factors are perceived as enhancing or inhibiting the process of computerization in health care?

DEFINITION OF TERMS

Attitude--an individual's feeling, position, orientation, or opinion toward a topic, subject or event.

Nurse educators--facuty members currently teaching in a nursing education program (all faculty must be licensed and have completed masters or doctoral degree preparation).

Nursing students--first and second year students enrolled in two year nursing education programs.

Perception--an individual's thought, understanding, or cognition relevant to a topic, subject or event.

Practicing nurses--registered nurses (diploma, A.D., B.S., and M.S. prepared) employed in general hospital settings.

METHODOLOGY

Questionnaires were sent to nursing personnel at two general hospitals, nursing educators at three associate degree schools of nursing, and student nurses at two associate degree nursing programs. Agencies participating in the study did not have hospital information systems or computer assisted instruction programs in operation at that time. Each participant was asked to respond to a series of twenty questions. Demographic information included age, sex, level of education, previous experience in health care delivery, and previous use of computers in the health care setting. Additional questions assessed the participants' views regarding the usefulness of the computer and the effect it may have on nursing and health care. Anonymity was maintained throughout the study--the identities of individuals who participated were not revealed and only group data were analyzed. The sample size was 83 first year nursing students, 84 second year nursing students, 52 practicing nurses, and 26 nursing faculty. Ten percent of the respondents were male; this reflects the national demographic trend of male representaton in the profession. Not all participants responded to all of the questions; for this reason, the actual number of data vary from question to question. The questionnaire response rate was 66%. Statistical analyses were performed using Chi square, cross tabulations and frequencies.

RESULTS

The results of the study fall into four general categories. These categories are: perceived value of computers in health care, perceived effect of computers on nursing practice, attitude toward learning about computers in health care, and perceived factors which facilitate or hinder the implementation of computers.

A. Value of Computers in Health Care

The first category deals with some basic attitudes that professional and pre-professional nurses have toward computers in the health care system. Specific questions assess previous experience with computers, and the perceived effect of this technology on health care.

Table 1. QUESTION: HAVE YOU HAD PREVIOUS EXPERIENCE WITH COMPUTERS IN A HEALTH CARE FACILITY?

	Previous experience (%)		
	No experience	Experience	TOTAL
Students	70.1	29.9	100
Practicing nurses	64.2	35.8	100
Nursing faculty	30.8	69.2	100

Chi-square = 15.2
** p < .0005

The data indicate that most of the respondents have not had experience with computers in a health care facility. However, it appears that nursing faculty have had this background as part of their professional experience. Just under 70% of the nursing faculty had worked with computers as compared to approximately a third of the nonfaculty personnel.

Table 2. QUESTION: DO YOU THINK THAT COMPUTERS WILL AFFECT HEALTH CARE?

	Potential effect (%)		
	Will affect	No affect	Total
Students	97.0	3.0	100
Practicing nurses	94.3	5.7	100
Nursing faculty	100	0	100

Chi-square = 1.87
$p < 0.39$

The response to this question is an overwhelming, "Yes, computers will affect health care in the future." Few of the participants disagree with this concept. There is no significant difference in responses among the members of the three groups.

Table 3. QUESTION: IF COMPUTER TECHNOLOGY DOES AFFECT HEALTH CARE, DO YOU BELIEVE THAT ITS INFLUENCE WILL BE POSITIVE OR NEGATIVE?

	Positive/negative influence (%)		
	Positive	Negative	Total
First year students	100	0	100
Second year students	97.6	2.4	100
Practicing nurses	94.1	5.9	100
Nursing faculty	100	0	100

Chi-square = 6.00
$p < .11$

Once again, the participants agree. The influence of computers will be positive. While a few responses were negative, it is clear that the great majority of nurses and nursing students feel that computers have something positive to add to health care.

B. Effect of Computers on Nursing Practice

The next category of questions deals with the general impact of computerization on nursing, and the specific areas of nursing which would be affected by the introduction of computer technology into the health care setting.

Table 4. QUESTION: DO YOU THINK THAT COMPUTERS COULD HELP YOU PERFORM YOUR NURSING DUTIES MORE EFFECTIVELY?

	Effectiveness (%)		
	More effective	Less effective	Total
First year students	93.7	6.3	100
Second year students	89.0	11	100
Practicing nurses	86.5	13.5	100
Nursing faculty	96.2	3.8	100

Chi-square = 3.11
$p < .38$

Members of each group strongly agree that computers would specifically aid nursing personnel in performing their nursing duties. This perception of the use of computers indicates that a few of the respondents seem to believe that computers will affect other components of health care more positively than it will nursing.

Table 5. QUESTION: WHICH NURSING SPECIALTY DO YOU BELIEVE WOULD BE MOST DIRECTLY AFFECTED BY THE INTRODUCTION OF COMPUTER TECHNOLOGY INTO THE HEALTH CARE SYSTEM?

Specialty	Frequency	Percent
ICU/CCU	78	34.2
Medical/surgical	51	22.4
Emergency/outpatient	46	20.2
Other specialty	23	10.1
Community health	15	6.6
Rehabilitation/extended care	12	5.2
Obstetrics/gynecology	2	.9
Psychiatric/mental health	1	.4
Pediatrics	0	0.0

Table 6. QUESTION: WHICH NURSING SPECIALTY DO YOU BELIEVE WOULD BE LEAST DIRECTLY AFFECTED BY THE INTRODUCTION OF COMPUTER TECHNOLOGY INTO THE HEALTH CARE SYSTEM?

Specialty	Frequency	Percent
Psychiatric/mental health	53	23.6
Community health	48	21.3
Rehabilitation	46	20.4
Emergency/outpatient	26	11.6
Obstetrics/gynecology	18	8.0
Other specialty	16	7.1
Pediatrics	7	3.1
ICU/CCU	6	2.7
Medical/surgical	5	2.2

The specialty which nurses believe would be most affected is the highly technologically oriented ICU/CCU. Conversely, nurses believe that the psychiatric/mental health specialty would be least affected. The trends displayed in tables 5 and 6 suggest that nurses think specialties such as ICU/CCU and medical/surgical nursing, which currently use a large amount of technology, will continue to be affected by new technologies, and that the less technological specialities such as mental health, community health, and rehabilitation will not be affected quite as strongly. The attitude reflected in these responses seems to be that those specialities currently using technology will increasingly be expected to work with computers and those specialities not currently involved will not be as dramatically affected.

Table 7. QUESTION: WHICH NURSING ROLE DO YOU BELIEVE WOULD BE MOST AFFECTED BY THE INTRODUCTION OF COMPUTER TECHNOLOGY INTO THE HEALTH CARE SYSTEM?

Role	Frequency	Percent
Staff nurse	91	38.2
Nurse researcher	56	23.5
Director of nursing/ supervisor	23	9.7
Head nurse	23	9.7
Office nurse	17	7.1
Nurse educator	8	3.4
Nurse practitioner	7	2.9
Clinical nurse specialist	7	2.9
Other role	6	2.5

Table 8. QUESTION: WHICH NURSING ROLE DO YOU BELIEVE WOULD BE LEAST AFFECTED BY THE INTRODUCTION OF COMPUTER TECHNOLOGY INTO THE HEALTH CARE SYSTEM?

Role	Frequency	Percent
Office nurse	74	31.9
Nurse educator	38	16.4
Staff nurse	37	16.0
Director of nursing/ supervisor	27	11.6
Nurse practitioner	19	8.2
Other role	15	6.5
Nurse researcher	9	3.9
Clinical nurse specialist	7	3.0
Head nurse	6	2.6

These data indicate that the two nursing roles which are perceived as being most affected by the computer are those of the staff nurse and the nurse researcher. When asked which nursing roles would be least affected, the respondents place office nurses and nurse educators at the top of the list.

C. Learning About Computers in Health Care

The third category of responses deals with perceptions of the survey participants regarding computer courses, and the respondents' willingness to take computer courses either as part of formal nursing education or as an inservice activity.

Table 9. QUESTION: DO YOU THINK THAT TO USE A COMPUTER EFFECTIVELY YOU NEED A STRONG MATH BACKGROUND?

	Math background (%)		
	Necessary	Not necessary	Total
First year students	18.3	81.7	100
Second year students	13.3	86.7	100
Practicing nurses	5.7	94.2	100
Nursing faculty	0.0	100.0	100

Chi-square = 8.83
* $p < .03$

This question indicates a difference in attitude among the four groups. While the great majority of participants do not believe that a strong math background is necessary, the data indicate that the student responses differ significantly from those of the nursing faculty and practicing nurses. More students hold the belief that math is important in using computers in a nursing setting, while none of the faculty and only a few practicing nurses agree.

Table 10. QUESTION: HOW WOULD YOU FEEL ABOUT TAKING A COURSE IN "COMPUTERS IN NURSING?"

	Students	Practicing	Faculty	Total
Confident	39.5	54.7	40.0	42.9
Comfortable	37.7	32.1	48.0	37.6
Neutral	13.8	5.7	4.0	11.0
Somewhat Uncomfortable	4.8	3.8	4.0	4.5
Apprehensive	4.2	3.8	4.0	4.1

NSD df=8

Table 11. QUESTION: SHOULD A COURSE IN COMPUTER LITERACY (USE OF COMPUTERS IN HEALTH CARE) BE REQUIRED FOR NURSING STUDENTS?

	NO	YES
Students	47.9	52.1
Practicing Nurses	24.5	75.5
Faculty	38.5	61.5

** $p < .01$ df=2

Table 12. QUESTION: SHOULD A COURSE IN COMPUTER LITERACY BE OFFERED AS AN ELECTIVE FOR NURSING STUDENTS?

	NO	YES
Students	11.0	89.0
Practicing Nurses	32.6	67.4
Faculty	16.7	83.3
TOTAL	15.8	84.2

** $p < .01$ df=2

Table 13. QUESTION: IF A COLLEGE COURSE OR CONTINUING EDUCATION OFFERING IN COMPUTER LITERACY WERE AVAILABLE, WOULD YOU ENROLL IN IT?

	NO	YES
Students	11.7	88.3
Practicing Nurses	9.6	90.4
Faculty	12.5	87.5
TOTAL AVERAGE	11.3	88.7

NSD df=2

Tables 10 - 13 present some interesting data. Most nurses are not afraid to enroll in a course in computer literacy. In fact, 80.5% of the respondents indicate that they would feel comfortable or even confident about taking such a course; only 4.1% express a feeling of apprehension. When asked if a course in computer literacy should be required for all nursing students, practicing nurses, nurse educators, and students nurses disagree significantly. The students are about evenly divided in their opinions; however, three of every four practicing nurses believe that a course should be required. Nurse educators support the idea at a ratio of two to one. Table 12 presents a seemingly contradictory situation. While students and faculty groups support the idea of having a computer course as an elective, the response rate of the practicing nurses falls from 75.5% (required) to only 67.4% (elective). Apparently, practicing nurses feel that knowledge of the use of computers in health care is sufficiently important that a computer literacy course should not be an optional matter, but rather that all new nurses should have a background in the subject. Table 13 indicates that all three groups of respondents would be interested in enrolling in a college or continuing education course in computer literacy. Appoximately 89% of the sample say that they will enroll if given the opportunity.

D. Factors Affecting Implementation of Computers

The final category of items deals with factors which facilitate or inhibit the introduction of computer technology into the health care setting.

Table 14. QUESTION: WHAT DO YOU BELIEVE WOULD BE THE MAJOR FACTOR IN BLOCKING THE IMPLEMENTATION OF COMPUTERS IN HEALTH CARE?

Factor	Frequency	Percent
Financial considerations	137	56.2
Nursing staff attitudes	48	19.7
Administration attitudes	33	13.5
Medical staff attitudes	20	8.2
Other factor	6	2.5

Table 15. QUESTION : WHAT DO YOU BELIEVE WOULD BE THE MAJOR FACTOR IN FACILITATING THE IMPLEMENTATION OF COMPUTERS IN HEALTH CARE?

Factor	Frequency	Percent
Administration attitudes	110	46.0
Financial considerations	57	23.9
Nursing staff attitudes	36	15.0
Medical staff attitudes	27	11.3
Other factors	9	3.8

Nurses identify the major obstacle to the implementation of computers in health care as the lack of money. This factor is followed by the attitudes of nursing staff. They also believe the major factor which could facilitate the implementation of computer technology to be a positive administrative attitude, and to a lesser degree an adequate supply of money.

DISCUSSION AND IMPLICATIONS

The results of this study are categorized into four general groups. The first of these categories is the perceived value of computers in the health care system. Although few of the respondents to the questionnaire have had previous experience with computers, they believe that this technology will have a profound effect on health care and that this effect will enhance the quality of health care. The second category examines how respondents perceive the effect of computerization on nursing practice. The opinion of the nurses is that they expect the more technologically oriented specialities to be most affected. Specialities such as ICU/CCU, medical surgical, and emergency outpatient nursing are expected to be most dramatically affected while the traditionally "human oriented" specialities like psychiatric/mental health nursing and community health nursing will be least affected. Two nursing roles are expected to be most affected by computers. Staff nurses and nurse researchers are at the top of the "most affected" list. This result is not particularly surprising since these two roles are now using computers in a number of hospital and university settings. However, the three roles believed to be least affected are office nurse, nurse educator, and once again staff nurse. The fact that the role of staff nurse is mentioned toward the top of each list indicates that some disagreement exists regarding the full impact on this particular nursing role. The third category of responses deals with the nurses' attitudes toward learning more about computers. Apparently the majority nurses do not suffer from a pronounced sense of cyberphobia. Most of the respondents indicate that they are not afraid of this emerging technology, and express a strong desire for learning more about the subject; they also strongly encourage nursing education to include a course on computer literacy in the nursing curriculum. These data suggest that leaders in the process of computer automation need not spend as much time as previously thought in "preparing nursing personnel to accept the computer." Rather time should be devoted to designing courses and implementing plans to effectively teach the nursing staff to use computers. The final category of responses deal with those factors which nurses believe will enhance or hinder the implementation of computers. As might be expected, financial considerations is identified as the number one factor to block the implementation of computers. Money is always a major consideration when introducing costly innovations. When asked which factors would most facilitate the implementation of computers, nurses indicate that a positive administrative attitude is most important. This implies that strong central administration support of computerization can have a significant, positive influence in the automation of a health care unit.

Replication of this study is recommended to validate the findings recorded here. Further study could also include data from respondents grouped according to formal nursing preparation (e.g. diploma, associate degree, baccalaureate, masters, and doctorate), to determine how formal education influences nurses' perceptions of computer automation in health care. An examination of attitudes and perceptions of various age groups regarding computer automation might also yield interesting and useful results. Reviewing data from these varied respondents could guide the nurse educator or nurse administrator who is planning for computerization and is considering the needs of the professionals or pre-professionals who will be affected by this process. Data comparing pre-computerization and post-computerization perceptions and attitudes of nurses could be useful in evaluating the impact of changes undergone, and the effectiveness of plans and strategies implemented. Such results may assist nurse administrators and educators when planning for the future technological advancements that are inevitable.

CONCLUSION

Throughout the literature may be found references discussing how nurses should approach the introduction of computer technology into the health care setting, and how nurses will respond to computer automation. Unfortunately, few hard data are available to support these claims. This study provides an empirical background. Among the findings of this study are the following: nurses are accepting, not opposing computer technology in the health care setting; nurses perceive the influence of computers on nursing and health care to be positive; nursing curricula should provide educational preparation in computer technology; continuing education offerings will be well-received by nursing; and nurses identify a strongly positive orientation by adminstrators as facilitating the computerization process in health care. Finally, these empirical data indicate a willingness among nurses to enter the information age with a progressive, positive orientation and with preparedness.

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RESEARCH ON TELETRAINING:

STUDENT ACCEPTANCE, LEARNING EFFECTIVENESS AND COST BENEFITS IN THE CORPORATE ENVIRONMENT

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INTRODUCTION

Previous research on teletraining has indicated that teletraining is a viable alternative delivery medium for short duration programs. Since 1981, AT&T has studied teletraining effectiveness for short continuing education programs and for multi-day courses. This paper highlights the 1984 research results and the benefits associated with using teletraining to deliver training to a nationwide audience.

BACKGROUND

The AT&T Communications National Teletraining Network was established to meet the needs of professional sales personnel located throughout the United States. Because of high costs associated with travel and travel time and the need to keep professional sales people up-to-date on the latest service information and technological developments, the National Teletraining Network was implemented.

In 1981, AT&T Communications began to offer professional sales courses to field locations via teletraining. These courses had duration which ranged from 2 days to 2 weeks. In October of 1983, the Sales and Marketing Education Division began to offer weekly one hour information updates to the field sales personnel throughout the United States. The program developed for teletraining delivery were topics that field sales managers had identified as high interest topics which were required to keep current in a competitive telecommunications environment.

In October of 1983, weekly programs were delivered to five cities, one from each AT&T Communications region. In November of 1983, five additional sites were added because of requests from field managers to include their cities on the National Teletraining Network. Since then the network grew steadily to a network of over 135 locations at the end of 1984.

The network today delivers weekly one hour programs and regularly scheduled teletrained courses which are periodically evaluated using a reaction level evaluation survey, course debriefings and cognitive pre and post tests. The number of programs and courses offered and the number of total participants who have attended National Teletraining Network programs grew steadily since the initiation of the project to over 21,000 by the end of 1984. Research studies were conducted to track effectiveness and trial new delivery techniques.

TELETRAINED RESEARCH

The Sales and Marketing Education organization has continually monitored the impact of teletraining on learning, on student acceptance of courses and instructors, and on student willingness to take additional teletrained programs. This section of the article reviews the research conducted during 1984.

Student Learning

Previous research conducted by Sales and Marketing Education has shown there is no significant difference between the amount students learn in classes that are teletrained and the amount learned in face-to-face classes. To continue with our ongoing research, comparative studies of test results are periodically conducted. The most recent study compared the test scores for students attending teletrained and face-to-face classes of the Telemarketing I course. The results for two classes are presented in Figure 1. The teletrained group performed slightly higher on the pre-test, but the difference between the two groups was not significant at the .05 level (t=1.73, df=20). On the post-test, the teletrained group's performance was significantly higher than the face-to-face group (t=6.24, df=20).

Student Acceptance of Courses and Instructors

All students attending courses at the AT&T Communications training centers complete a student reaction survey at the end of each class. The survey has two categories: course relevance and design, and quality of instruction. The last item in each category is used as a general index of student satisfaction. The items are: "Overall, I feel the course was effective." and "Overall I feel the instructor was effective." These two items were used to compare student acceptance of the face-to-face and teletrained courses.

During 1984, courses in the sales training curriculum were converted to teletrained delivery. As the transition was being made to a teletrained delivery mode, the courses continued to be taught face-to-face. Modifications were made in the design of the courses to adapt to the medium of teletraining; however, the course objectives and the instructors were the same for both the face-to-face and teletrained versions of the courses. During the study period, a total 329 students attended 45 face-to-face classes, and 590 students attended 32 teletrained classes.

Significance tests for large-sample means were used to compare the data for all face-to-face classes with the teletrained scores for the second half of 1984. The teletrained classes from July through December were used because the courses were progressively being converted to teletrained delivery during the first half of the year. The results of these analyses are shown in Figures 2 and 3. No significant differences at the .05 level of significance were found between the face-to-face and the teletrained classes on either the course relevance and design or the quality of instruction categories. This research supports the conclusion that students do not perceive a difference in effectiveness between courses delivered in a teletrained delivery mode and those delivered in more traditional face-to-face classes.

Acceptance of National Teletraining Network Programs

A short questionnaire was used to evaluate the effectiveness of the one-hour teletraining programs offered to the sales force via the National Teletraining Network. The most important item on the questionnaire was: "I would participate in future teletraining courses." This item was measured on a five-point scale and was used as an indicator of student acceptance of these programs. Figure 4 shows the results on this item for the first three quarters of NTN programming. The percent agreement with the statement, as indicated by a rating of 4 or 5, was 88.7% in the fourth quarter of 1983, and rose to 91.6% in the second quarter of 1984. Similarly, the percent unwilling to participate in future programs declined from 1.5% to .8% respectively. Since the results were uniformly positive across the 5,530 students who participated in the programs, the use of the form was discontinued in the third quarter of 1984 to reduce administrative costs.

Student acceptance of the one-hour teletrained programs began high and increased with time. Today, these short programs are an integral part of the training delivery system. The teletraining seminars are a primary vehicle for introducing new applications and for keeping the field sales people up-to-date on important issues and services.

The research done at Sales and Marketing Education during 1984 focused on demonstrating that teletraining is an effective training medium as measured by student learning and acceptance. The results of the studies presented here strongly support the conclusion that teletraining is a viable instructional delivery mode.

COST BENEFITS OF TELETRAINING

The National Teletraining Network produced significant cost benefits for AT&T Communications in 1984. Major savings were realized for both the multiple-day courses and the one-hour seminar programs delivered via the NTN. The savings resulted from travel costs and productivity-related costs that were avoided by using the teletraining medium. The information presented here substantiates the fact that teletraining is a cost-effective alternative to face-to-face delivery of training.

Savings from Teletrained Courses

In computing the cost benefits for the courses delivered via teletraining, the assumption was made that students would have had to travel to Sales and Marketing Education in Cincinnati to received this training if teletraining were not an alternative. During 1984, 590 students attended teletrained sessions of courses in the sales training curriculum. An average round-trip airfare of $400 and a per diem of $90 per day for lodging and daily expenses resulted in a total cost avoidance per student of $670 per course. The average course length was 2.6 days. The total savings for 590 students was $395,300.

The cost avoidance from not traveling is offset somewhat by the line and bridge charges associated with teletraining. A typical teletrained course at Sales and Marketing Education had one "home site" and two remote sites. This configuration incurred charges for six lines (one audio and one audiographic for each location), and six ports on the bridge (two for each location). Bridging costs were based on the AT&T Communication's ALLIANCE* Teleconferencing Services. Equipment and other capital investments were not considered in these calculations since existing equipment was used; only operating expenses were included. Using these assumptions, the total network charges for the 57 teletrained sessions was $197,448. Subtracting these network teletraining charges from the cost avoidance figure produced a net savings of $197,852, or $335 per student.

Travel cost avoidance was only part of the actual savings realized from teletraining. Employee productivity savings needed to be factored into the computations; that is, the reemployment of non-productive time spend traveling, waiting in airports, and catching up once back at the home location. Assuming the average non-productive time was six hours per student, then the total lost-time expense for 590 students was $84,960, or $144 per student. Adding this savings to the earlier travel cost figure of $335 per student produced a total net cost avoidance of $479 per student.

This data supports the assertion that teletraining is clearly a cost-effective way to deliver courses. The benefits included both direct travel expense avoidance, and increased productivity resulting from reduced no productive time.

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*A service mark of AT&T.

Savings from Programs

Similar calculations were performed to determine the cost avoidance for the programs presented via the Network. The following two assumptions were made in doing these calculations. First, students from the 130 field locations would not travel to the Sales and Marketing Education Center in Cincinnati to participate in a 60-minute training session; therefore, each presenter would have to travel to approximately 25 major sites to deliver the training. Second, students would utilize ground transportation from local or remote locations to attend a training session in one of the 25 locations.

If each presenter had traveled to 25 locations costs incurred would have been $90 for local expenses and $400 for airfare; the travel cost for each presenter would have been $12,250. For the 44 programs presented in 1984, the total cost avoided was $539,000.

The cost benefit analysis for the seminar programs also accounts for the costs associated with the operation of the National Teletraining Network. The cost of the long distance calls placed to Cincinnati by each of the remote locations was $83,028. These programs did not use any interactive graphic devices; therefore, only one telephone circuit was required for each remote location. Since a meet-me premises bridge located at Sales and Marketing Education was used, no additional bridging charges were incurred. The expenses incurred for the reproduction of visuals used for the programs during 1984 was $38,754. The total cost avoidance for the 1984 National Teletraining Network programs was $417,218, a net savings of $9,482 per program.

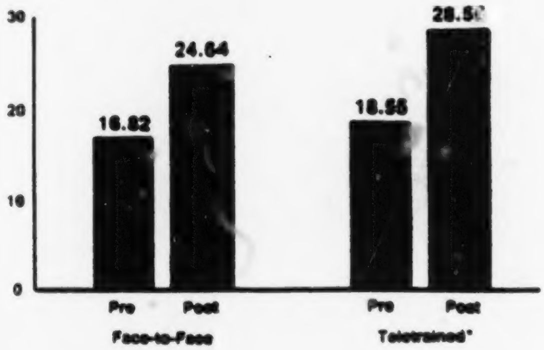
The cost-benefit calculations indicate that the National Teletraining Network is a cost effective method for providing update training for AT&T Communications. Benefits of the NTN in addition to cost-effectiveness include: the ability of this medium to reach remote, low density locations which are too difficult and time consuming to reach through conventional travel arrangements; the ability to add multiple locations to a training session when needed; the flexibility to increase the number of students who can be reached at one time; the ability to quickly disseminate information to an entire sales force; and the ability to share limited instructor resources. Without the NTN, much of the current update training would not be attempted due to various constraints. Perhaps the chief benefit of the National Teletraining Network's programs is that it provides training to field sales people, where they need it and when they need it to remain current in a competitive environment.

CONCLUSION

The National Teletraining Network has had a positive impact on the field sales force within AT&T Communications in three major areas. First, sales professionals have had an opportunity to keep current and to increase their knowledge base of products and services in a very timely manner. Studies conducted within AT&T Communications have shown that teletraining is a viable means of learning technical information and sales skills. Second, student acceptance of the National Teletraining Network's programs and the teletrained courses has been outstanding. Students indicate that teletraining is a viable medium for delivering content which addresses sales skills and technical information. Third, the National Teletraining Network's weekly programs and teletrained courses have been proven as very cost-effective alternatives to traditional delivery channels for professional sales and marketing education.

FIGURE 1

Telemarketing I Courses
Pre and Post Results



*Significant at $p <.06$

FIGURE 2

STUDENT ACCEPTANCE OF COURSES

	Teletrained*	Face-to-Face**
Sessions	32	45
Mean	4.03	4.18
Standard Deviation	.42	.42

No significant difference
($z=1.52$, $df=75$, $p=.06$)

* July - December 1984

** All of 1984

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FIGURE 3

STUDENT ACCEPTANCE OF INSTRUCTORS

	Teletrained*	Face-to-Face**
Sessions	32	45
Mean	4.54	4.57
Standard Deviation	.27	.31

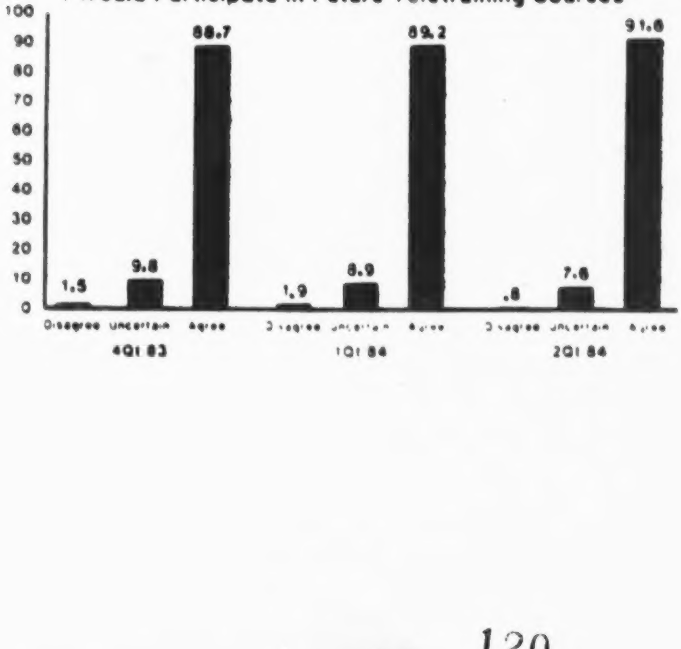
No significant difference
(z=.45, df=75, p=.33)

* July - December, 1984
** All of 1984

FIGURE 4

STUDENT ACCEPTANCE OF NATIONAL TELETRAINING NETWORK PROGRAMS

"I Would Participate in Future Teletraining Courses"



A Comparison of the Effects of LOGO Use and Teacher-Directed Problem-Solving Instruction on the Problem-Solving Skills, Achievement, and Attitudes of Low, Average, and High Achieving Junior High School Learners

by

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Running head: The Efficacy of LOGO

Abstract

With the advent of basic skills curricula throughout the United States, many educators have become increasingly concerned with an apparent lack of emphasis on higher-level thinking skills, specifically, problem-solving skills.

To address this concern, many school districts and individual teachers have adopted the use of the LOGO programming language to teach problem-solving skills. The many assertions regarding the efficacy of LOGO in improving learner achievement, attitude, and problem-solving skills made by the proponents of LOGO have made LOGO seem ideally suited for classroom application. Unfortunately, many of these assertions have yet to be tested empirically.

In this study, the effects of LOGO use were compared with a program that provides instruction in problem-solving strategies, as well as with a control group, using six dependent measures, two on each of the following constructs: achievement, attitude, and problem-solving skills.

The results of the study indicate that neither LOGO nor the Problem-Solving treatments produced significant improvement in basic skills proficiency or general attitudes. However, both LOGO and the Problem-Solving group were successful in improving learner attitudes related to mathematics.

In addition, the Problem-Solving group scored significantly higher on both measures of problem-solving skills than did the LOGO group, demonstrating that the benefits of LOGO may not transfer beyond the LOGO environment.

A Comparison of the Effects of LOGO Use and Teacher-Directed Problem-Solving Instruction on the Problem-Solving Skills, Achievement, and Attitudes of Low, Average, and High Achieving Junior High School Learners

There is considerable evidence to suggest that computer-assisted instruction (CAI) is a highly effective mode of delivery for instruction in a wide variety of instructional settings (Kulik, 1983).

Yet, Papert (1980), the creator of the LOGO programming language and author of the controversial text Mindstorms, argues that CAI is not an appropriate use of the microcomputer. Papert argues that CAI does not allow the learner to control the learning, so the learning content becomes separated from the child's reality, and hence, insignificant.

Papert believes that LOGO's turtle geometry is an ideal vehicle for teaching problem-solving skills. It is Papert's contention that children are able to "relate to the turtle," and that learning becomes more concrete and hence, easier and more relevant. Because the learning is more relevant, Papert and other proponents of LOGO (Lawler, 1980; Watt, 1982) believe that LOGO use leads to improved learner attitudes. In addition, because the learner is able to articulate his/her thinking, they assert that LOGO has meta-cognitive benefits that enable the learners to improve their performance with basic skills and transfer newly acquired problem-solving skills to new learning situations.

On the other hand, other authors have noted what they feel is a lack of applicability of the LOGO language in the framework of the traditional public school curriculum (Steffin, 1983).

Although it has been used and tested extensively at the Artificial Intelligence Laboratory of the Massachusetts Institute of Technology since the late 1960s, LOGO is relatively new in the public school system, appearing in microcomputer form around 1980. Because of this late start, little research has been conducted on the efficacy of the LOGO language. Much of the writings concerning LOGO to date are very "soft" in nature, typically describing an author's experience in integrating LOGO into his/her classroom.

Until recently, the only empirical data available on LOGO had come only from the M.I.T. researchers themselves. Although these studies are objective in nature, many serious questions as to their external validity exist, especially considering much of this research has been conducted on large, main frame computers, rather than the microcomputers in use in the schools. Hence, to date, many of the propositions surrounding the use of LOGO and its benefits are virtually untested.

Clearly, many questions concerning the efficacy of LOGO remain unanswered and more research is required. This study compared he effects of LOGO use with teacher-directed problem-solving instruction and conventional mathematics instruction on the problem-solving ability, basic skills achievement, and attitudes of junior high level learners.

Methods

Subjects

The subjects chosen for this study were 97 seventh grade learners, selected from five sections of a seventh grade mathematics course. Few of the learners in this sample had previous experience with LOGO and none of the learners had been exposed to the problem-solving strategies employed in the problem-solving treatment.

There was an approximately equal distribution of males and females in the group. The sample was composed primarily of Anglo students (n = 85) with only s small amount of minority students (n = 12).

Materials

Three instructional treatments were employed: a problem-solving strategies instructional treatment, a structured LOGO treatment, and a control.

Problem-Solving. This treatment consisted of approximately 20 hours of instruction in problem-solving strategies. The lessons in this treatment consisted of self-contained, print-based worksheets, designed to function entirely as stand-alone instruction. The learners were given the appropriate worksheets and directed to work independently.

The lessons of this treatment focused on six problem-solving strategies: "Guess and Check," "Make a Table," "Patterns," "Make a Model," "Elimination," and "Simplify." Materials for all of the six strategies were adapted from Teaching Problem-Solving Skills (Dolan & Williamson, 1983).

LOGO. In this treatment, the learners were provided with approximately 20 hours of computer time in which to explore the turtle graphics capabilities of the Terrapin LOGO language on the Apple II microcomputer system. Each learner was provided with a lesson which contained a list of new commands and exercises which guided exploration of these commands. Each learner worked independently to complete the lesson. Each lesson also contained a difficult, culminating activity on which the learner focused after completion of the preliminary activities of the lesson.

Prior to the beginning of the study, all teachers involved were given a briefing on the type of intervention that should occur so that the types of suggestions given to the learners would be consistent across all groups.

Control. Learners in this group were given additional time for completing any school assignments and/or recreational reading.

Dependent Measures

In addition to the three treatments described, the learners were assessed on their achievement, attitudes, and higher-level thinking skills.

Achievement Measures. There were two measures of achievement used in this study. The first of these measures was the district administered Program Criterion Reference Test (PCRT). This test is a measure of the student's mastery of the grade level objectives. The test contained 80 multiple choice items, four for each of the 20 objectives. Using data obtained from this study yielded a split-half reliability coefficient of 0.78.

The second achievement measure used in this study was mathenatics subtests of the Comprehensive Test of Basic Skills. The split-half reliability coefficient for the combined scales was found to be 0.90, using data from this study.

Attitude Measures. Student attitude was also evaluated with two measures. The first of these two measures was the Revised Math Attitude Scale, a Likert-type questionnaire. Learners were asked to respond to 20 statements on a five part scale, ranging from "Strongly Agree" to "Strongly Disagree." The split-half reliability coefficient of the survey was found to be 0.93.

The second attitude scale used in this study was the School Attitude Measure (SAM). The SAM is also a Likert-type survey that contains 85 questions pertaining to attitudes toward school, teachers, and attitudes towards education in general. Data collected in this study indicated that the split-half reliability coefficient of the SAM was 0.78.

Prior to administering the attitude scales, the learners were assured that their responses would be judged "blindly," and that their annonymity would be protected. They were then encouraged to respond honestly to the scales' items.

Problem-Solving Skills Measures. Two measures of problem-solving skills were used in this study: the Test of Cognitive Skills (TCS) and the Test of Non-Routine Problem-Solving Skills (TNRPSS).

The TCS consists of four sections: "Memory," "Analogies," "Sequences," and "Verbal Reasoning." Data from this study yielded a split-half reliability coefficient of 0.88 for the TCS.

The Test of Non-Routine Problem Solving Skills was developed by this author in consultation with teachers familiar with teaching and assessing problem-solving skills. This scale consists of 20 items that measure non-routine problem solving skills. These problems are open-ended in nature with several possible solutions. The learner was able to select the solution strategy he/she wished to employ to solve the problem. This test was scored dichotomously, with the correct answer receiving one point and an incorrect answer receiving no points.

The final version of the TNRPSS was obtained by analyzing test-item data from an original pool of 85 items. The split-half reliability coefficient of the final version of the TNRPSS was found to be 0.76.

Procedure

Students in five seventh grade mathematics classes were systematically assigned to the three treatments previously described from the five class rosters.

Students were then designated as high, average, or low in prior achievement based on sixth grade CTBS scores.

Prior to the beginning of the study, the learners were informed that the treatment groups would be rotated after the initial assignments had been completed.

Each of the learners was then subjected to their respective treatments for two instructional periods, approximately 45 minutes each, per week over a period of two months, 20 sessions in all.

At the end of the experimental period, each learner was posttested on the dependent measures. The experimental data were analyzed as follows.

Experimental Design and Data Analysis

Data from this study was analyzed through a fixed-effects ANOVA for each of the dependent measures. The design of the experiment was a 3 x 3, two-factor design, featuring three levels each of treatment group, LOGO, Problem-Solving, and Control, and prior achievement, High, Average, and Low.

Dependent measures included two measures of posttest achievement (the mathematics subtests of the Comprehensive Test o Basic Skills and the seventh grade Program Criterion Referenced Test), two measures of student attitude (the School Attitude Measure and the Revised Math Attitude Scale), and two measures of problem-solving skills (the Test of Cognitive Skills and the Test of Non-Routine Problem-Solving Skills).

Results

Test of Cognitive Skills

The cell means for the TCS are shown in Table 1. Both achievement level means and treatment group means were significantly different ($p = .001$) as shown in Table 2, the ANOVA for this result.

The Problem-Solving Group differed significantly from the Control, but not from the LOGO group, while the High group differed significantly from the Low group, but not the Average Group.

Insert Tables 1 and 2 about here.

Test of Non-Routine Problem-Solving Skills

The cell means for the TNRPSS are listed in Table 3 and the ANOVA is found in Table 4. These means did not differ significantly (p = .05). However, the mean of the Problem-Solving group was significantly larger (p = .001) than the means of the Control and the LOGO groups, although the means of the LOGO and Control groups themselves did not differ significantly (p = .05).

Insert Tables 3 and 4 about here.

Comprehensive Test of Basic Skills

The cell means for the mathematics CTBS are given in Table 5. There was no signifificant treatment main effect (p = .05), as shown in the analysis of variance table, Table 6. However, the achievement means were significantly different (p = .001). Specifically, the High group scored significantly higher than either the Average or Low group. However, the means of the Average and Low groups were not significantly different (p = .05).

Insert Tables 5 and 6 about here.

Program Criterion Referenced Test

The means for the achievement level groups were all significantly different for the PCRT (p = .001). However, there were no significant differences among the treatment group means (p = .05).

Insert Tables 7 and 8 about here.

Revised Math Attitude Scale

The cell means for the RMAS are given in Table 9 and the ANOVA is shown in Table 10. The means for the treatment groups were significantly different (p = .001). Both the LOGO and Problem-Solving group means were significantly greater than that of the Control group. However, the means of the Problem-Solving and LOGO groups themselves were not statistically different (p = .05).

In addition, the mean for the Low group differed significantly from the mean of the High group (p = .05). However, the means of the Low and Average groups did not differ significantly, nor did the means of the Average and High groups (p = .05).

In addition to these main effects, there was also a significant (p = .001) interaction between treatment and achievement. This interaction is plotted in Figure 1.

Insert Tables 9 and 10 and Figure 1 about here.

School Attitude Measure

Cell means for the SAM are given in Table 11. Neither treatment group means nor the achievement group means differed significantly ($p = .05$) , as shown in Table 12, the ANOVA table for this measure.

Insert Tables 11 and 12 about here.

Discussion

There are three main results from this study that warrant further discussion and analysis. First, neither treatment group, LOGO or The Problem-Solving strategies group, demonstrated any improvement in basic skills achievement as the result of the experimental intervention.

Much of the research on mastery based instructional programs has supported the notion that the learner must actively become immersed in the knowledge or skill that is being learned for mastery to become a reality. In this study, no such intensive basic skills learning took place. Although this type of basic skills instruction is not the aim of LOGO there have been many assertions made as to the efficacy of LOGO in improving the basic skills achievement of learners. The results of this experiment indicate that neither LOGO, nor more conventional problem-solving instruction, produce improved learner achievement., principally due to the lack of focus on these skills.

Second, the Problem-Solving group scored significantly higher than did the Control or LOGO groupon both measures of problem-solving skills. In this case, learners given specific instruction in problem-solving strategies were able to apply this new knowledge to a variety of new problems, whereas learners subjected to a more general learning experience such as LOGO were not able to respond appropriately to new situations. This result again supports the body of conventional research that asserts that specific, well-designed instructional interventions can have positive impacts on learning outcomes. In addition, this result suggests that LOGO's "top-down" thinking model may not transfer to problems outside of the LOGO context.

Finally, although there were no significant results on the School Attitude Measure, there were highly significant differences on the Revised Math Attitude Scale. The SAM measures a variety of general attitudes towards school, teachers, and learning. These attitudes are influenced by years of development, as well as a variety of factors outside of the school itself. It may therefore be logical to conclude that a much more dramatic treatment must be employed over a longer time frame in order to produce significant changes in this type of evolved attitude trait.

However, learners in the LOGO and Problem-Solving groups scored significantly higher than their counterparts in the Control group on the Revised Math Attitude Scale. Yet, neither treatment, LOGO nor Problem-Solving, scored significantly better than the other. Both of these treatments represented something different from the normal classroom routine of these students. Therefore, it is likely that these improved attitudes are, in some part, attributable to a novelty effect.

Finally, the significant Achievement by Treatment interaction present with the RMAS indicates that Low learners in the LOGO and Problem-Solving groups scored far higher than High or Average level learners, while Average-level learners seemed to prefer the Problem-Solving treatment overall, while High learners responded favorably only to the LOGO treatment.

These results, coupled with observations made during data collection indicate that the novelty effect earlier mentioned is most pronounced for the Low learners, who have generally been unsuccessful with conventional classroom instructional practices. It is this type of student that Papert (1980) suggests is benefited most greatly by LOGO. However, the results from this study indicate that virtually any new intervention, especially one in which success comes quickly and easily, is likely to produce substantial improvements in the attitudes of low learners.

The favorable attitudes of Average-ability students toward the material in the Problem-Solving treatment may result from the fact that these materials were designed specifically for "average" learners. In addition, many of these learners have had a variety of computer experiences in previous math classes and in other content areas. Therefore, the novelty effect may have been less strong for these learners.

High learners also responded favorably to LOGO, but less favorably to the Problem-Solving treatment. This result is likely due to the materials of the Problem-Solving treatment were somewhat simplistic for their ability level. Observations indicated that high level learners often developed their own problems to solve in the LOGO environment. Solving this type of personal problem was undoubtedly more challenging and rewarding to these students.

In summary, the results of this study suggest that the problem-solving skills fostered through LOGO use may not transfer outside the context of LOGO, since LOGO apparently provides only a single algorithm which may not apply to many types of non-routine problems. In contrast, the problem-solving strategies taught as part of the Problem-Solving treatment were highly effective in improving the problem-solving skills of these learners. Both the LOGO group and the Problem-Solving group demonstrated an improvement in attitudes related to mathematics instruction. This improvement was, in part, attributed to a novelty effect.

Neither treatment group demonstrated an improvement in more general attitudes or basic skills achievement. This lack of improvement was attributed to the lack of a specific focus on these two constructs. by the materials in these treatments. The results of this study suggest that specific, well designed interventions targeted at specific types of learning can be effective in producing improvements in these learnings. However, non-specific interventions such as LOGO may not be nearly as effective.

It should be noted that the LOGO treatment used in this study was only one of many possible applications of LOGO and it is possible that other applications of LOGO, over longer periods of time, would produce different results and more research with these applications should be conducted. However, based on the results of this study, LOGO does not produce the effects often suggested by its proponents.

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Table 1. Mean percent scores for the Test of Cognitive Skills (TCS).

	Control	PS	LOGO	TOTAL
Low	43.05 (N=9)	59.03 (n=9)	52.50 (n=8)	51.49 (n=26)
Average	60.18 (n=7)	76.81 (n=11)	67.19 (n=8)	69.38 (n=26)
High	74.75 (n=10)	78.58 (n=7)	75.62 (n=12)	76.04 (n=29)
TOTAL	59.85 (n=26)	71.34 (n=27)	66.61 (n=28)	66.01 (n=81)

Table 2. Fixed-effects analysis of variance for the Test of Cognitive Skills (TCS).

SV	SS	df	MS	F
Treatment (T)	1217.21	2	608.60	7.22[a]
Achievement (A)	5409.43	2	2704.72	32.08[b]
TA	305.77	4	76.44	0.91
s:TA	6070.32	72	84.31	

[a] $p < .001$

[b] $p < .001$

Table 3. Mean percent scores for the Test of Non-Routine Problem-Solving Skills (TNRPSS).

	Control	PS	LOGO	TOTAL
Low	25.00 (n=9)	50.56 (n=9)	21.25 (n=8)	32.69 (n=26)
Average	21.43 (n=7)	47.27 (n=11)	27.50 (n=8)	34.23 (n=26)
High	33.00 (n=10)	54.29 (n=7)	29.58 (n=12)	36.72 (n=29)
TOTAL	27.12 (n=26)	50.19 (n=27)	26.61 (n=28)	34.63 (n=81)

Table 4. Fixed-effects analysis of variance for the Test of Non-Routine Problem-Solving Skills (TNRPSS).

SV	ss	df	MS	F
Treatment (T)	10388.95	2	5194.47	20.31[a]
Achievement (A)	825.27	2	412.64	1.61
TA	331.24	4	82.81	0.32
s:TA	18417.96	72	255.81	

[a] $p < .001$

Table 5. Mean percent scores for the mathematics Comprehensive Test of Basic Skills (CTBS).

	Control	PS	LOGO	TOTAL
Low	58.39 (n=8)	58.04 (n=9)	62.35 (n=7)	59.41 (n=24)
Average	68.24 (n=6)	74.01 (n=11)	80.15 (n=8)	74.59 (n=25)
High	87.69 (n=13)	91.47 (n=8)	88.24 (n=10)	88.85 (n=31)
TOTAL	74.68 (n=27)	73.87 (n=28)	78.40 (n=25)	75.55 (n=80)

Table 6. Fixed-effects analysis of variance for the mathematics Comprehensive Test of Basic Skills (CTBS).

SV	ss	df	MS	F
Treatment (T)	266.07	2	133.03	0.71
Achievement (A)	8376.86	2	4188.43	22.43[a]
TA	270.26	4	67.57	0.36
s:TA	13256.39	71	212.09	

[a] $p < .001$

Table 7. Mean percent scores for the Program Criterion Referenced Test (PCRT).

	Control	PS	LOGO	TOTAL
Low	49.63 (n=8)	49.33 (n=9)	53.00 (n=7)	50.50 (n=24)
Average	58.00 (n=6)	62.91 (n=11)	68.13 (n=8)	63.40 (n=25)
High	74.54 (n=13)	77.75 (n=8)	75.00 (n=10)	75.52 (n=31)
TOTAL	63.48 (n=27)	62.79 (n=28)	66.64 (n=25)	71.01 (n=80)

Table 8. Fixed-effects analysis of variance for the Program Criterion Referenced Test (PCRT).

SV	SS	df	MS	F
Treatment (T)	665.87	2	332.94	1.91
Achievement (A)	16253.54	2	8126.77	46.73[a]
TA	1242.17	4	310.54	1.79
s:TA	12347.31	71	173.91	

[a] $p < .001$

Table 9. Mean percent scores for the Revised Math Attitude Scale (RMAS).

	Control	PS	LOGO	TOTAL
Low	57.50 (n=10)	73.00 (n=10)	74.00 (n=9)	67.97 (n=29)
Average	62.90 (n=10)	69.15 (n=13)	67.44 (n=9)	66.72 (n=32)
High	62.08 (n=13)	61.22 (n=9)	68.69 (n=13)	64.31 (n=35)
TOTAL	60.94 (n=33)	68.13 (n=32)	69.87 (n=31)	69.22 (n=96)

Table 10. Fixed-effects analysis of variance for the Revised Math Attitude Scale (RMAS).

SV	ss	df	MS	F
Treatment (T)	1417.25	2	708.62	22.32[a]
Achievement (A)	208.01	2	104.00	3.28[b]
TA	859.59	4	214.90	6.77[c]
s:TA	2761.64	87	31.74	

[a] $p < .001$

[b] $.01 < p < .05$

[c] $p < .001$

Table 11. Mean percent scores for the School Attitude Measure (SAM).

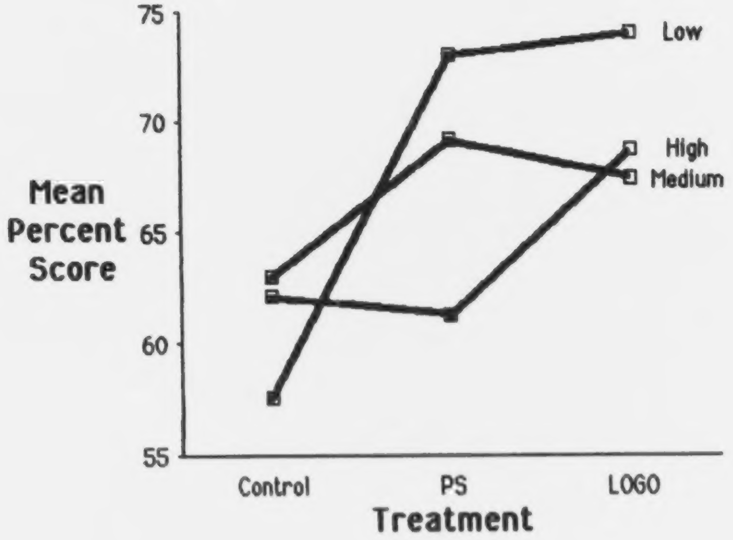
	Control	PS	LOGO	TOTAL
Low	69.63 (n=10)	70.66 (n=10)	67.01 (n=9)	69.17 (n=29)
Average	70.53 (n=10)	72.43 (n=13)	72.53 (n=9)	71.87 (n=32)
High	71.56 (n=13)	69.10 (n=9)	73.46 (n=13)	71.63 (n=35)
TOTAL	70.66 (n=33)	70.94 (n=32)	71.32 (n=31)	70.97 (n=96)

Table 12. Fixed-effects analysis of variance for the School Attitude Measure (SAM).

SV	SS	df	MS	F
Treatment (T)	30.24	2	15.12	0.02
Achievement (A)	1311.86	2	655.93	0.97
TA	1914.78	4	478.69	0.71
s:TA	58673.83	87	674.41	

Figure Caption

Figure 1. Achievement-by-Treatment Interaction for the Revised Math Attitude Scale (RMAS).


75
70
65
60
55
Mean Percent Score
Control
PS
LOGO
Treatment
Low
High
Medium

The Effects of Video-only, CAI only, and Interactive Video Instructional Systems on Learner Performance and Attitude: An Exploratory Study

by

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Running head: INTERACTIVE VIDEO

The Effects of Video-only, CAI only, and Interactive Video Instructional Systems on Learner Performance and Attitude: An Exploratory Study

Computer-assisted instruction (CAI) has had beneficial effects on learner achievement in a wide variety of instructional settings. Research has shown that CAI not only improves learner achievement, at times by as much as 50%, but can also reduce the amount of time necessary to accomplish the same amount of learning (Kulik, 1983).

CAI has been effective with a wide variety of learners and in many different types of instructional settings (Charp, 1981). In addition, CAI has had positive effects on improving the affective outcomes of instruction, such as learner attitude and self-esteem (Dalton & Hannafin, 1985; Clement, 1981). The favorable attitudes of learners who participate in computer-assisted instructional programs have been attributed to the fact that the computer had infinite patience, never showed signs of anger or frustration, and left the learners with a general feeling of having learned "better."

Yet, despite the many instructional benefits associated with the use of CAI, there are many instructional situations in which CAI simply is not adequate (Martorella, 1983). For example, computer generated graphics are generally not capable of depicting intricate, visually-oriented instructional sequences, such as surgical procedures or flight training, with the realism that is required.

On the other hand, video images can present instruction with a realism that is not possible in CAI. However, although video-based instruction has been effective in many situations, the many instructional benefits of the typical CAI are lost (Russell, 1984). Since video-based instruction is generally non-interactive, the possibilities for individualized pacing, feedback, and reinforcement are greatly diminished.

Many authors note that video often becomes a passive instructional medium where learners do not actively participate in the learning and hence, simply "turn-off" to the instruction (Gendele & Gendele, 1984).

In the past decade, computer and video technologies have been merged to form a new promising media known as "interactive video." With this new technology, the learners are shown a segment of video instruction and asked questions about that segment by the computer. The computer can then perform the same functions as it does in more conventional CAI: inputting and judging the learners' responses, providing feedback and reinforcement, and record keeping.

The possibilities for improving CAI with video images through interactive video instruction seem very promising. Current research indicates that the variety of visual and auditory learning stimuli present in interactive video can dramatically improve learning (Clark, 1984).

In addition, a recent study noted that the interactive nature of interactive video can not only improve short-range recall, but can also aide in retention (Schaffer & Hannafin, 1984). However, this study also demonstrated that excessive amounts of interactivity in interactive video do not appreciably effect performance or retention, but drastically impact the efficiency of the instruction presented.

Although the many assumptions made about interactive video make it seem ideally suited for many educational and training settings, there are many questions concerning the use of interactive video technology that have yet to be answered. This study compared the effects of interactive video instruction on learner performance and attitude, with conventional CAI and stand-alone video, in order to determine exactly what types of learning tasks best lend themselves to interactive video instruction

Materials and Methods

The 134 subjects for this study were selected from six introductory level junior high Industrial Arts Exploration classes. The basic learning consisted of a set of 27 General Shop Safety Rules. In general, each of the rules involved a visually-oriented task or behavior required of the learners. Three parallel forms of instruction were employed: Video-only, CAI only, and Interactive Video. The video-only lesson consisted of a 15 minute video presentation on the safe use of tools. Learners were shown a short narrated segment that depicted both an example and non-example of the correct behavior. The CAI-only lesson used the narrator's script as the basis of a tutorial lesson. The interactive video lesson combined the video segments from the video lesson with the tutorial from the CAI lesson.

Prior to the beginning of the study, the learners were designated as relatively high or low in prior achievement based on their sixth grade total Comprehensive Test of Basic Skills scores. They were then randomly assigned to one of the three treatment groups described. At the conclusion of the lesson, the learners were given a print-based posttest, covering the rules that had been presented in the three treatments, and a survey to address their attitudes towards the instruction.

Design and Procedures

This study employed a completely crossed 3 x 2 x 2 treatment by achievement by sex factorial design, featuring 3 levels of treatment (video only, CAI only, and interactive video), and three levels of prior achievement (high, average, and low) based on CTBS scores. Dependent measures included one measure of performance and one measure of attitude toward instruction.

Posttest performance scores were analyzed with ANCOVA procedures, using prior achievement as the covariate. Attitude scores were analyzed with ANOVA procedures.

Findings

The means for the treatment groups on the performance measure were 64.98%, 73.54%, and 70.48% for the Video, CAI, and Interactive Video treatments, respectively. The means of all three groups were significantly different at the alpha = .05 level.

In order, the attitude scale means of the Video, CAI, and Interactive Video treatment groups were 75.07%, 74.26%, and 82.87%. The mean of the Interactive Video group was significantly higher than both the CAI and Video only groups at the alpha = .005 level. However, the means of the Video group and the CAI group were not statistically different.

In addition to the treatment main effect on the attitude scale, there was also a significant Achievement by Treatment Interaction.

Implications of the Study

There are three major findings from this study that warrant discussion: a) CAI alone tends to the the most effective instructional delivery system for the type of learning task chosen for this study, b) interactive video instruction produced significant improvements in learner attitudes when compared with CAI and Video alone, and c) the attitude effects observed in this study were not constant across prior achievement level.

It might be assumed that the interactive video treatment, by virtue of its video enhancements and individualization, would be the most effective in producing high levels of performance. However, this assumption was not supported by this study for two principal reasons. First, the interactive video equipment was very new to these students. Observations made during the lessons indicate that these learners were somewhat distracted by the various noises and indicator lights produced by the videotape players in this treatment. Second, the delays caused by long tape access times may have given the learners the opportunity to drift and not actively participate in the instruction. On the other hand, these learners were familiar with CAI lessons, so this media provided no such distractions and its more direct nature seemed to keep these learners more "on task."

Although the learners using the CAI lesson performed best, the interactive video lesson was successful in improving learner attitudes towards the instruction. This improvement in learner attitude may be the result of the more motivating nature of the "natural" video images or the immediate reinforcement provided by the computer (Bejar, 1982). Unfortunately, as noted earlier, the learners involved in this study had never used this kind of delivery system before. Therefore, the differences in observed attitudes may, in part, be attributable to a novelty effect.

However, the most important finding of this study is that the attitude differences observed varied across prior achievement level. Specifically, low ability students scored dispropotionately lower on the CAI lesson than low learners in the other treatment groups. What, then, could account for this strongly negative reaction to the CAI treatment by low ability learners?

In the school chosen to participate in this study, CAI has been used for approximately four years, primarily for remediating the basic skills deficiencies of low-ability learners. Perhaps CAI, when used only in a remedial capacity, can have the same stigmatizing effects often observed with low ability learners are placed in conventional "special" programs. The results of this study support the notion that a great deal of care is warranted in the use of CAI, and remedial programs in general, if these detrimetal effect are to be avoided.

In summary, the results of this study indicate that CAI can be a highly effective mode of instruction where the additional capabilities provided by interactive video are not required. In addition, both interactive video and CAI are more effective in producing high levels of performance than video only, substantially due to their ability to keep learners more actively participating in the learning. Finally, although CAI can be used to effectively improve learner attitude, like other types of instructional media, CAI can have deliterious effects on learner attitude if used in a manner where low ability learners feel demeaned or isolated because of their additional needs.

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Author notes

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WORD PROCESSING AND THE WRITING PROCESS: ENHANCEMENT OR DISTRACTION?

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RUNNING HEAD: Word processing

Abstract

Although highly-designed, outcome-based computer-based instructional interventions have been successful in inproving the basic skills of learners in a wide variety of educational settings, little research has been conducted on more open-ended computer learning activities, such as word processing.

The present study examined the effects of a year-long word processing program on learners' hollistic writing skills. Learners were in the treatment group used a word processor three times per week to complete their writing assignments, while students in the control used conventional print-based writing techniques.

Results from this study suggest that word processing is especially effective for low ability students. However, there were several logistical problems related to access to the computers encountered during the study that may have prevented more dramatic results.

WORD PROCESSING AND THE WRITING PROCESS: ENHANCEMENT OR DISTRACTION?

Introduction

Highly-designed, outcome-based computer-assisted instruction (CAI) has been effective in a wide variety of instructional settings (Kulik, 1983). Yet, it has been suggested that the great potential benefits of instructional applications of computer-based technologies lie in more open-ended computer activities such as word processing, where the computer is used more as a learning tool than as an electronic tutor (Dudley-Marling, 1985).

Traditionally, writing skills have been taught by two distinct approaches: the reductive approach and the hollistic approach (Hartwell, 1985). In the reductive approach, writing is taught by focusing on discrete, often isolated mechanical skills, including punctuation, syntactical rules, etc.

The hollistic approach concentrates attention on the process of writing and largely neglects instruction in specific mechanics, the assumption being that if learners concentrate on the meaning and the production of the text as a whole, the mechanical skills will follow. With this approach, learners are taught that the writing process consists of three distinct steps: pre-writing or planning, writing, and most importantly, revision (see Figure 1). This approach to writing instruction is now the most popular (Moffet, 1968).

Insert Figure 1 about here.

There is evidence to support the efficacy of the hollistic approach to writing instruction. In a study comparing the two approaches, no significant differences were found in the writing quality between treatment groups, leading the authors to conclude that the reductive approach, while leading to better mechanical skills, does not improve the overall quality of the writing product (Meckel, 1963). In addition, it has been noted that the hollistic approach can be especially effective in improving the writing skills of low-achieving learners, since these students tend to get bogged-down with the form, rather than the substance of the text (Rose, 1983).

In a recent review of the literature comparing the two approaches to writing instruction, it was noted that some authors found that mechanical approaches can often have deliterious effects on the overall quality of students' writing (Hartwell, 1985).

To date, computers have been used to support writing mechanics through the use of drill and practice and tutorial CAI. The RSVP project conducted in the Miami/Dade County schools found that this type of computer instruction did improve the learners' mechanical skills, but had no discernable impact on the overall quality of their writing products. The "Writing to Read" project sponsored by IBM (Blum & Furlong, 1983) has also supported this lack of efficacy of the reductive approach.

The potential benefits of word processing technology in assisting learners within the hollistic approach, especially in the revision portion of the process, seem somewhat obvious. Yet, very little empirical study has been conducted to date. A recent study conducted with elementary students reported that the inclusion of word processors in the writing program produced significant improvements in the attitudes of the learners (Willer, 1985) Specifically, it was noted that the learners involved in the study had favorable attitudes towards the revision process when accomplished on the microcomputer and spent more time in the revision process. In addition, favorable results have been reported when word processors have been used with primary age learners (Phenix & Hannan, 1985)

Although the potential of word processing in aiding the writing process seems great with elementary learners, many questions as to the efficacy of this technology with other populations remain.

This study examined the effects of a year-long hollistic writing program that used word processing technology to aide learners in revising their writing on learners' writing skills.

Methods

Subjects

The subjects of this study were 80 seventh grade students, drawn from four remedial language arts courses. Learners were placed in the remedial programs based on below-average sixth grade Comprehensive Test of Basic Skills (CTBS) scores and through the reccommendations of their sixth grade teachers. Although below-average in language skills, many of these learners possessed average to above-average skills in other content areas, such as mathematics and science.

Materials

Two treatments were employed: a word processing treatment and a conventional writing process treatment.

Word processing treatment. Over a period of one academic year, students in the word processing group completed all of their respective writing assignments on an Apple IIe microcomputer equipped with the FreeWriter word processsing program. The FreeWriter program is a moderately powerful public domain word processing program which possesses editing features including the abilities to find and replace errors, move text blocks, and format documents on screen. Each student was furnished with their own word processing and data diskettes and provided with aproximately three instructional periods of computer time per week.

The students were given two weekly writing exercises to complete on the word processor. This exercises included developing fictional short stories, writing letters, and expository prose. These exercises typically required the learner to produce between one and two pages of text each. In addition to the writing exercises, the students completed four major written papers. The students were given a general topic and asked to produce a final printed document of between three and five pages.

Conventional writing program. Students in the conventional writing program used pen-and-paper methods to complete the same types of writing activities.

Procedure

Prior to the beginning of the study, the learners were designated as relatively high or low in prior writing achievement based on results of a writing pretest.

The learners were then assigned to their relative treatment groups were they completed

At the conclusion of the study, the learners were given a standardized writing test, which was scored by three independent, "blind" examiners. The evaluations of each of the three examiners was combined to form a combined score.

These writing samples were evaluated by each examiner on the following five criteria: structure and organization, correct usage of the parts speech, punctuation, capitalization, and spelling.

Experimental Design and Data Analysis

The design of this study was a 2 x 2 completely crossed treatment by achievement factorial design, featuring two levels of treatment (word processing and conventional writing), and two levels of prior achievement (high and low).

Posttest writing sample scores were analyzed with ANOVA procedures.

Results

The percent cell means for the writing sample are given in Table 1. Overall, the mean of the relatively high achieving learners was 77.56%, while the mean of the relatively low achieveing learners was 71.06%. These means were significantly different at the $p = .01$ level as shown in Table 2, the analysis of variance table for this result.

Insert Tables 1 and 2 about here.

The mean for the word processing group was 75.69%, while the mean of the conventional writing group was 72.94%. These means were not significantly different. However, there was a significant ($p = .10$) Achievement by Treatment Interaction. This interaction is depicted graphically in Figure 2.

Insert Figure 2 about here.

Discussion

There are two results from this study that warrant further discussion. First, there was a significant achievement by treatment interaction. This interaction indicates that the relatively low achieving learners scored significantly better if they used the word processing treatment than low learners in the conventional.

This result supports much of the previous research that suggests that the writing skills of low achieving learners and other special populations can be greatly benefited by word processing technology even though other types of "special" interventions have had little effect.

In addition, this result and observations made during the study support the notion that word processing can make the revision process more facile and less frustrating for these learners. Specifically, the teachers involved in this study noted that the learners using the word processor required less encouragement to revise drafts of their writing assignments and generally spent more time in thr revision process than their counterparts using pencil and paper methods.

Interviews conducted with learners in this study suggest that the word processor made the writing process more pleasant because correcting errors was simplified and the computer eliminated much of the physical discomfort with which many of these learners have associated the writing act.

However, it should be noted that there was no treatment main effect observed in this study. Specifically, word processing was not effective for the relatively high ability students. Observations conducted during the study and interviews conducted at the conclusion of the study indicate that this lack of efficacy was the result of two main factors.

First, many students had significant trouble in keyboarding. Learners at this age level have been exposed to little formal typing instruction. As a result, they spend an inordinately large amount of time "hunting" about the keyboard before the can "peck" a key. Many learners stated that they found this task excessively time consuming and distracting when compared with pencil and paper writing. In fact, several noted that typing problems effectively interrupted their concentration while writing.

The second major problem with the word processing treatment was the disruptive nature of the accessing the hardware necessary. In this school environment, all of the school's computers are grouped into two laboratories. Although ready access was not a problem during the period of time required for the study, each trip to the computer lab seemed to be a "mini field-trip."

Several students stated that they preferred remaining in class working, rather than the disruption of relocating in the computer lab. In addition, other students said that they often purposefully wasted time during the required transitional periods.

Finally, several students in the word processing group noted that they often neglected the careful planning that they would have ordinarily performed prior to actually composing the draft. The attributed this neglect to their impression that the word processor simplified editing to such an extent that planning was no longer as important as it had been with conventional paper and pencil writing. One student noted that the consequences of poor planning while using the word processor were not a severe since "with computer, so what if you have to start over?"

Although this study demonstrated that word processing has the potential to provide an instructional environment that can be beneficial to the writing skills of low achieving learners, several important questions remain and further research should be conducted.

Future studies should investigate three issues concerning the instructional uses of word processing. First, an appropriate mode of providing basic keyboarding skills should be investigated. Perhaps an introductory module on keyboarding should be provided to all the students in a manner analguous to basic handwriting skills. Clearly, the lack of these skills is a serious impediment to developing writing skills with the word processor.

Second, varied hardware configurations should be examined in order to find the basing mode in which the type of distractions observed in this study might be minimized. For example, potential solutions including using a dedicated computer classroom should be investigated. In any event, the disruptive arrangements encountered during this studied should be minimized to the extent possible.

Finally, future studies should determine ways in which outlining and other pre-writing activities can be emphasized, along with the re-writing and editing phases of the writing process. There are several relatively new computer-assisted project planning programs that are available. Perhaps such a package might provide a suitable method with which planning skills might be developed.

In summary, the results of this study suggest that, with the exception of several significant logistical problems associated with the implementation of the computers themselves, word processing technology, because of its ability to greatly simplify the re-writing phase, may provide the ideal medium for the development of hollistic writing skills for many learners.

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Table 1. Writing sample cell means in percent.

	Word Processing	Control	TOTAL
High	$\bar{X}$ = 77.13 s = 10.10 (n = 16)	$\bar{X}$ = 78.00 s = 8.85 (n = 16)	$\bar{X}$ = 77.56 s = 9.35 (n = 32)
Low	$\bar{X}$ = 74.25 s = 7.86 (n = 16)	$\bar{X}$ = 67.88 s = 7.71 (n = 16)	$\bar{X}$ = 71.06 s = 8.32 (n = 32)
TOTAL	$\bar{X}$ = 75.69 s = 9.02 (n = 32)	$\bar{X}$ = 72.94 s = 9.65 (n = 32)	$\bar{X}$ = 74.31 s = 9.37 (n = 64)

Table 2. Analysis of variance for the writing sample.

Source	SS	df	MS	F
Achievement (A)	676	1	676	8.96[a]
Treatment (T)	121	1	121	1.60
A x T	210.25	1	210.25	2.79[b]
Within (error)	4527.50	60	75.46	

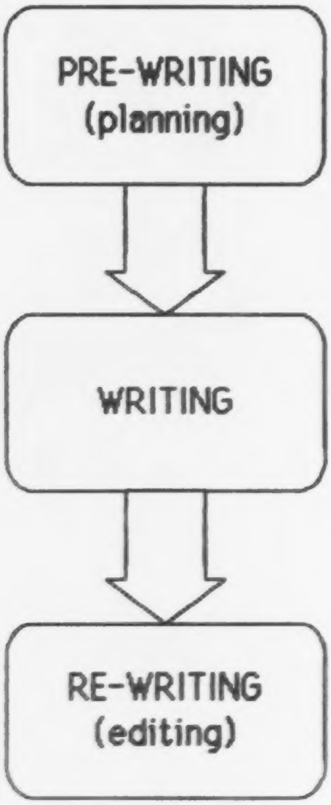
[a] $.001 < p < .01$

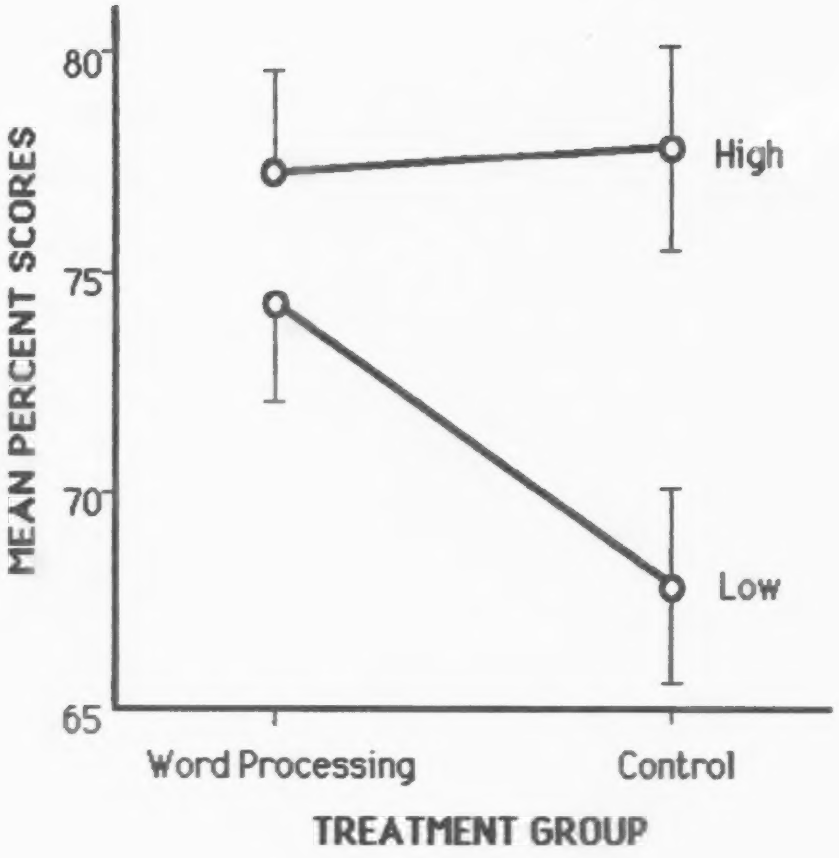
[b] $.05 < p < .10$

Figure Captions

Figure 1. The writing process including pre-writing, writing, and re-writing.

Figure 2. Achievement by Treatment interaction for the writing sample.


PRE-WRITING
(planning)
WRITING
RE-WRITING
(editing)


80
75
70
65
MEAN PERCENT SCORES
High
Low
Word Processing
Control
TREATMENT GROUP

A COMPREHENSIVE STUDY OF THE OPERATIONAL PROBLEMS OF HIGHER EDUCATION AFFILIATED CABLE TELEVISION STATIONS

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A COMPREHENSIVE STUDY OF THE OPERATIONAL PROBLEMS OF HIGHER EDUCATION AFFILIATED CABLE TELEVISION STATIONS

Abstract

For the past 40 years television has been primarily delivered by a limiting open-air broadcasting medium. The steady establishment of cable television within communities, recent technological developments in cable carrying capacity, and the loosening of FCC regulations have all fostered the potential for rapid cable growth and utilization. With increasing market penetration, many colleges and universities have or will affiliate with local or regional cable systems providing a mutually beneficial relationship for training, programming, and public access.

The purpose of the presentation will be to report upon a selective and intensive survey which focused upon documenting and identifying operational problems these affiliated stations are having in accomplishing their respective missions. Results from the study will help in providing an understanding of the current range of operations and assist other colleges and universities to examine this option in television and education.

The primary areas of interest consisted of station: (1) organization; (2) budget; (3) personnel; and (4) equipment.

The paper will concentrate on the most significant problems identified given the four primary areas of interest. The paper will also provide recommendations that may be used by higher education institutions that are considering developing a cable facility and those existing facilities looking for ways to improve.

A COMPREHENSIVE STUDY OF THE OPERATIONAL PROBLEMS OF HIGHER EDUCATION AFFILIATED CABLE TELEVISION STATIONS

Background

For the past 40 years, television has been primarily a broadcasting medium. Signals were transmitted from antennas located on towers and picked up by home antennas. This system limits the amount of channels that can be broadcast due to overlapping and interference. Nearly one-half of the U.S. television audience cannot receive more than six broadcast channels; many receive less and the picture quality is inferior on many of the channels (Smith, 1979).

However, cable television has the potential to end the scarcity of channels. Many existing cable systems carry 20 television channels and some up to 40 (Williams, 1982). Fiber optics developed at Bell Research Labs make possible a greatly increased channel capacity, numbering into the thousands of channels (Bittner, 1981).

Further cable growth has been fostered by the elimination of some FCC regulations in 1978 by the courts (Levenson, 1980). Estimates of cable growth are that 50% of about 95 million projected households in 1995 will be purchasing cable services. In the early 1980's, cable penetration is a little over 20% of 77 million households (Williams, 1982).

Many colleges and universities have television studios and often they are affiliated with local cable systems. These studios have several purposes with the most important being the instruction and training of students. However, many of these studios also provide public access for the community to the local cable company's channels. A study is needed to determine what problems these studios are having in accomplishing their mission. Such a study would be a help in providing an understanding of the services available and assisting other colleges to examine the option in television and education.

Purpose

This study will focus on examining college and university affiliated cable television stations and the identification of their operational problems.

The purpose of this study is to present data on problems and concerns that a college should consider before starting a cable affiliated station.

There are four research questions that will be examined by the study. These questions will center around four areas; organization, budget, personnel, and equipment. The four research questions to be answered are:

1. What organizational concerns can be identified in college and university cable affiliated stations?

2. What budget concerns can be identified in college/university cable affiliated stations?

3. What personnel concerns can be identified in college and university affiliated stations?

4. What equipment concerns can be identified in college/university cable affiliated stations?

Methodology

Ninety-two directors or chief executives of higher education affiliated cable stations were surveyed. A developed questionnaire consisting of over 100 identified variables, clustered under the four primary areas of interest, served as a controlled protocol for the 20 to 30 minutes in-depth telephone interviews. The majority of the questions requested a reaction to a statement along a value-continuum scale. The protocol also provided the opportunity for open-ended commentary which was later synthesized given identified patterns.

The consuming method of telephone interviews proved invaluable, resulting in information not readily attainable through other research methods. The 100% participation, frankness, and enthusiastic support of this research effort by those interviewed became rapidily apparent given the unique focus of this survey - on cable systems alone. For an indepth report on the methodology and a copy of the final questionnaire used in this study see Dudt and Lamberski, 1986.

Analyses of Demographic Information

The survey gathered information from 87 college- and university- affiliated cable stations across the United States. There were 23 private colleges and universities and 64 public colleges and universities.

The size of the institutions of higher education surveyed varied a great deal. The smallest college had an undergraduate student enrollment of 780 students and the largest university had 65,000 undergraduate students.

The graduate enrollments of the surveyed institutions varied also. Twenty-six of the colleges/universities did not offer graduate education at all while one university had 10,000 graduate students.

A slight majority of the colleges and universities surveyed had ongoing continuing education programs, 46 or 52.9%. However, there were 37 institutions that housed cable facilities that could not answer the question. These directors did not know if their institution provided continuing education.

During the discussion on continuing education (non-credit adult education) with the directors, it was noted that only one director was using the station for non-credit adult education. The 37 directors that did not answer the question were totally unaware of their institutions efforts in this area.

The institutions were divided into three demographic areas; urban, suburban and rural. An urban institution was defined as an institution that was located within the city limits of a major metropolitan center of 50,000 or more people. A suburban institution was located within a one-hour drive of a major metropolitan center, a rural institution was more than a one-hour drive from a major metropolitan center. The majority of the institutions, 49 or 56.3%, were located in rural areas.

There is a great variation in the age of the higher education affiliated television stations; one station was founded in 1957 and the late in 1984. There was a growth throughout the 1960's and 1970's with continual but slower growth in the 1980's.

Thirteen facility directors were unable to establish when their stations began. Several of the directors were new to their positions and some said that there had been so much staff turnover over the years that the date had been lost.

Generally, it takes four years once a station has been founded to become affiliated with a cable company. The earliest date for cable affiliation was found to be 1966, according to the directors surveyed, with the latest affiliation being January of 1985. There were only four directors that were unable to identify when their stations became affiliated with the cable company.

Programming of the vast majority (97%) of the higher education affiliated cable stations is part of the basic cable fee. In other words, individuals within the community receiving cable do not generally have to pay extra to get the college's/university's cable station. There were only six colleges/universities whose programming was not included within the basic cable fee.

The basic cable fee varied for $5 to $23 for cable service (all dollar figures were rounded to the nearest dollar). Twenty-five of the directors or 28.7% did not know what the basic cable fee was in the community where their programming was presented to the public. It is important to note that not all programming developed by a college/university is presented on the local cable. If there was no local cable company, often the programs were carried by a nearby company in another town or city. This helps explain why the directors were unfamiliar with the price system of the cable company.

There were only six surveyed facilities that had programming whose costs were not included in the basic cable fee. Only one director knew what the additional fee was for his programming. His cable company's basic fee was $10 to get the pay television channel that carried the facility's programming. The other five directors had their programming on pay television channels but did not know what the consumer's fee was to obtain the programming.

The population of the communities that could potentially receive the surveyed facilities programming varied greatly, ranging from the smallest at 900 to the largest at 1.5 million. There were 22 directors that did not know accurately their community's population.

A large majority of the directors (72.4%) did not know how many households were getting cable and could receive their facility's programming. The 24 directors that did know generally how many households could receive their programming gave a large range from 200 households to 170,000 households.

Analyses of Station-related Problems

"What organizational concerns can be identified?"

Problems areas in instructional programming, reporting relationships, cable company relationships and public access were explored.

The most serious problem faced by the directors in providing instructional programming was inadequate funding. Some of this problem was caused by the general lack of funds in higher education, but there was also a lack of faculty and administrative support for the effort in some schools. Several directors related that their administration wanted the instructional programming but were unwilling or unable to fund the efforts at the proper level. Each director also stated that within the colleges and universities there was a minority core of faculty members that were against televised instruction. It is interesting to note that nowhere did unions provide insurmountable problems in providing televised instruction or telecourses.

Although the college/university administrators gave lip service to supporting the station's programming, they did not back this up with money for equipment and personnel. This was a serious problem for the directors.

Almost all of the stations had a four-year period of growth and adjustment before they became affiliated with a local cable company. This allowed for a stabilization of staff and programming before cable casting was begun.

Although the stations had a variety of administrative models, there were generally few problems in day-to-day management. The chain of command and the power structure were not usually perceived as a problem. A few problems arose, however, when the source of funding conflicted with the day-to-day workload. This was especially true when the station was attached to an academic department and the station received its funds directly from the administration instead of through the department.

Generally there were few problems in the higher education cable stations relationship with the cable company. Once the cable channel has been provided, most cable companies have a "hands-off" approach. There are two problems that directors warned of: one -- do not share the channel with another programming source and two -- do not rely on the cable company for upgrading or maintenance of equipment.

Sharing the channel with another programming source creates problems for the higher education station according to the directors and very few still have a shared channel. Sharing the channel limits the station on when it can program and often causes a very uncomfortable competitive atmosphere. If the shared programming is popular, several directors stated, then the local public asked the cable company to provide more of the programming and less of the college's programming. One college station lost its channel due to this problem.

Most of the higher education affiliated cable stations do no have a functioning advisory board even though there is an advisory board "on paper." Most of the directors do not recognize a need to have an active advisory board.

Unless the higher education's affiliated station's programming is popular in the community, the cable company will not upgrade equipment or provide any type of maintenance. Most higher education directors do not have an equipment or maintenance relationship with the cable company.

Providing public access to the community is not generally a problem for the station. Most directors believed the benefits outweigh the problems. Public access affords an opportunity to provide realistic productions and programming experience for students.

"What budget concerns can be identified?"

Many directors believed that the college/university administrations wanted the station to provide more services than they were willing or able to pay for. Funding is a problem that some directors were unable to solve. The directors believed that they had a constant problem in educating the administration on the high cost of television.

Generally speaking, the cable companies have no, or relatively few, financial commitments to the station. The service that they most often provide is wiring and the transmission of the station's signal to the head end.

Most of the higher education affiliated cable stations only cable cast on the local cable system. Only four higher education facilities had developed linkage with other cable companies.

"What personnel concerns can be identified?"

The largest problem that the directors faced was that they had too many additional responsibilities besides the station's operations. Many directors were also teaching faculty members and were given a one course teaching load reduction. Several directors stated that this was not enough of a reduced teaching load. Many directors also complained that there were not enough professional staff to oversee the work load and this created a heavy reliance on students. The reliance on students also caused some problems getting work done in a professional and timely manner.

The heavy time demands placed on the directors also caused problems with professional development. Several directors stated that they were not current in the latest developments in the television field. Care must be taken by these colleges/universities to prevent this from happening.

"What equipment concerns can be identified?"

The biggest problem that the directors had was a lack of equipment. The large number of students working at many of the stations created a need for more equipment than the university expected. Common equipment components that were needed were: remote equipment (switches, cameras, lights) and more editing facilities.

Important components were often missing and the quality was not at a desired level for many directors. Often the colleges/universities bought the equipment that they believed would minimally do the job. This equipment would then prove incapable of providing the technical quality expected. There was also a tendency to not buy new equipment soon enough and some directors were using equipment that was either worn out or outdated.

A lesser equipment problem that many directors faced was inadequate physical plant. Little or no air conditioning, low ceilings or high noise levels from the studio were common problems.

Recommendations

This study provides information that may be used by higher education institutions that are considering developing a cable affiliated facility and those existing facilities looking for ways to improve. Recommendations 1-3 offer suggestions for planning and 5-10 suggest ways to developing the station.

1. A newly formed higher education facility should not immediately become affiliated with a cable company. Most existing facilities took four years from creation to cable affiliation. This time period allows the station staff to develop procedures, personnel and gain production experience. This conflicts with Zoglin (1981) who believes that a cable channel must be obtained before higher education makes a commitment.

2. A higher education affiliated facility should have complete control of its channel. This channel should carry only programs that are approved by the higher education institution. This action will ensure the station's programming does not compete with programming from other profesional sources. Highly popular commercial entertainment has caused at least two stations to lose their channel to higher rated programs when the general public asked the cable company for more entertainment.

3. Create a functional advisory board and use it to develop a clear mission statement. Clemens (1980) has developed clear purposes for the advisory board. Most existing stations do not use advisory boards for long-range planning or to help in solving the major problems. This involvement of the community can help improve the public relations of the college (Clinton, 1981; Zoglin, 1981).

4. Develop a close relationship with the college/university administration. Many administrators do not understand the complexities of television and its

production; this lack of understanding often causes a lack of support. Many directors also believed that their facility was not getting its fair share of existing college/university resources. This may also be due to a general unawareness of the possibilities television offers (Carpenter-Huffman, Kletter and Yin, 1971).

5. Involve other faculty members in the stations operations. This increased involvement by higher education faculty benefits both the faculty and the station. Faculty benefit by having an outlet for research (Kichi, 1979) and an avenue for public service (Clinton, 1981). The higher education station benefits by the energy and input of the faculty members.

6. Develop linkages with other nearby cable companies. This would expand the infulence of the station and the college/university. Few of the facilities surveyed where programming on more than one cable system. According to Zoglin (1981), this might create tension with the cable company; however, this researcher does not agree. Most cable companies do not have a large commitment to the college cable station and its programming. This finding agrees with Comanor and Michell, (1971).

7. Purchase the best quality equipment possible. The cable station will be on the dial with commercial stations and noticably poorer technical quality will hurt the stations professional image. Audiences expect quality production (Brown, 1975; Turek, 1979) and the college/university must make this commitment to be successful.

8. The college/university should hire a full-time director. Currently, the station directors are forced to wear too many hats; teachers, administrators and production coordinators. This has led to staff turnover, a heavy reliance on students and inadequate ongoing professional staff development. Most directors are now working on one half or one quarter release time from other duties.

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A METHODOLOGY IN STUDYING HIGHER EDUCATION AFFILIATED CABLE TELEVISION STATIONS

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A METHODOLOGY IN STUDYING HIGHER EDUCATION AFFILIATED CABLE TELEVISION STATIONS

Abstract

The purpose of this paper is two fold. First, to present a developed methodological approach for the study of cable television stations affiliated with higher education institutions; and second, to present the signficant findings detailing the operational problems of higher education affiliated cable television stations.

The paper will highlight an extensive literature search and a resulting conceptual framework utilized throughout the investigation. The literature search helped identify over 100 variables. The conceptual framework developed identified and clustered critical issues of concern on the operations of cable television stations. Variables were clustered under the four primary areas of interest: (1) organization; (2) budget; (3) personnel; and (4) equipment.

A constructed questionnaire which addressed this conceptual framework provided the guided protocol used during the 20 to 30 minute telephone interviews. Ninety-two directors or chief executives of higher education affiliated cable stations were surveyed.

Internal and external validity of the questionnaire was controlled in part by extensive pre-study screening by professional reviewers. Subsequent instrument revisions allowed for a majority of questions to be presented as a statement to which a reaction along a value-continuum scale would be offered. The instrument also provided the opportunity for open-ended statements which were analyzed post-hoc given perceived patterns.

The investigators will identify strategies and techniques utilized in the development of the questionnaire protocol. The consuming telephone survey method will be discussed in terms of results and impact not readily attainable through other research methods.

Discussion of the research findings will focus upon the four major areas of interest. Data summaries will be presented concentrating on the most signficant problems identified.

A METHODOLOGY IN STUDYING HIGHER EDUCATION AFFILIATED CABLE TELEVISION STATIONS

Background

For the past 40 years, television has been primarily a broadcasting medium. Signals were transmitted from antennas located on towers and picked up by home antennas. This system limits the amount of channels that can be broadcast due to overlapping and interference.

However, cable television has the potential to end the scarcity of channels. Many existing cable systems carry 20 television channels and some up to 40 (Williamns, 1982). Fiber optics developed at Bell Research Labs make possible a greatly increased channel capacity, numbering into the thousands of channels (Bittner, 1981). Further cable growth has been fostered by the elimination of some FCC regulations in 1978 by the courts (Levenson, 1980).

Many colleges and universities have television studios and often they are affiliated with local cable systems. These studios have several purposes with the most important being the instruction and training of students. However, many of these studios also provide public access for the community to the local cable company's channels. A study is needed to determine what problems these studios are having in accomplishing their mission. Such a study would be a help in providing an understanding of the services available and assisting other colleges to examine the option in television and education.

Purpose

This study will focus on examining college and university affiliated cable television stations and the identification of their operational problems.

The purpose of this study is to present data on problems and concerns that a college should consider before starting a cable affiliated station.

There are four research questions that will be examined by the study. These questions will center around four areas: organization; budget; personnel; and, equipment. The four research questions to be answered are:

1. What organizational concerns can be identified in college and university cable affiliated stations?

2. What budget concerns can be identified in college/university cable affiliated stations?

3. What personnel concerns can be identified in college and university concerns affiliated stations?

4. What equipment concerns can be identified in college/university cable affiliated stations?

Methodology

Content Analysis

The purpose of this study was to gather data on the operational problems of college and university affiliated cable television stations. Survey research was utilized to gather the information as Babbie (1973) stated that survey research is useful in discovering the distribution of certain traits or attributes. A descriptive survey was used, which according to Isaac and Micheal (1979), will collect data systematically to describe a situation or area of interest factually and accurately.

The method for data collection was telephone interviews. This method of collecting data was chosen due to very poor response rate to the initial pilot mailing. Out of 20 questionnaires distributed as a pilot test, only four were returned. An alternative method of collecting data, telephone interviews, was therefore selected.

The total identifiable population was 92 directors. These facilities were identified from two sources: TV Guide Almanac; and the Journalism Directory 1983.

The following professional organizations were also contacted in an unsuccessful effort to identify more facilities; Alpha Epsilon Rho; the Association of Educational Communications and Technology; the Broadcast Education Association; and the National Cable Television Association.

It was also felt that the highest response rate would be obtained by telephone interviews. This proved correct as 87 of the 92 directors that were in charge of facilities were interviewed. Thus, the response rate was 94.5%. Participation was further encouraged in the promise that results would be sent to each director.

Procedures

Eighty-seven of the 92 directors of higher education affiliated cable stations across the United States were interviewed. Telephone interviews ensured that the correct person answered the questions and provided an opportunity of immediate clarification. Station listings in TV Guide Almanac and the Journalism Directory 1983 were useful in identifying facilities but contained may errors when identifying the appropriate director. Some facilities had temporary or revolving directors making it more difficult to identify who was in charge at the present time. The secretary that answered the telephone was always able to give accurately and quickly the director's name. Often several telephone calls were necessary to establsh an appointment to do the interview.

The interviews were conducted during the months of November and December of 1984. Each interview took an average of 20 minutes with a few taking as long as a half hour.

The interview took the following format. First, the interviewer would give some background information on the project and the purpose of the research. Secondly, the interviewer would explain the questionnaire and its format. This would take one or two minutes after which the interviewer would proceed through the questionnaire one question at a time until all the questions were completed. All directors were encouraged to volunteer infromation that was not covered by the questions. Few took the opportunity to provide any additional comments as most seemed to believe that the answer choices provided by the questionnaire were satisfactory as to scope.

Instrument Development

Before constructing the questionnaire, informational interviews and discussions with various professionals associated with the cable television industry and higher education were held. These discussions led to the development of a preliminary questionnaire that was validated by a team of experts. The validators were each sent a draft of a questionnaire and were asked to respond to any inconsistencies or ommissions. There were also follow-up interviews with the validators that focused on criticisms of the instrument in order to more fully redefine the questionnaire.

The validatiors were chosen carefully in order to provide input that was not only broad in scope but also specialized. All validators had a broad background in television, higher education and were able to bring unique talents that were neeeded to develop the questionnaire, The validatiors were also used as a pilot test. This was helpful in perfecting the interview technique before the other directors were interviewed.

Questionnaire

The survey questionnaire is divided into two parts; a copy of the complete questionnaire is provided in the Appendix. The first part helps identify some demographic information about the cable station. The second part requests specific information concerning the station and related problems based upon the primary research questions.

Data Analysis

The data obtained from 87 completed interviews were coded and entered into the SPSS (Statistical Package for the Social Sciences) program housed in the Honeywell level 66 computer at the Indiana University of Pennsylvainia. There were 106 questions with 15,322 data points for this research project.

Several types of statistical data were obtained upon analysis. There were frequency counts for all answers, adjusted for missing data. Occassionally there were questions that the directors were unable or unwilling to answer, resulting in missing data.

Exploratory analysis of data revealed trends, identified problems, and exposed areas of further research.

Highlighted Findings

This investigation examined data obtained form telephone interviews to 87 higher education affiliated cable television stations. The comprehencsive study focused upon the primary areas of interest: I. Organization; II. Budget; III. Personnel; and, IV. Equipment.

The following outlined summary of the major findings is not presented in rank order; rather, highlighted issues or statements are provided within these primary areas of interest.

I. ORGANIZATIONAL PROBLEMS/STATEMENTS

a. The data indicates a consistent finding of inadequate funding by most colleges and universities. The areas of equipment and personnel were most typically cited.

b. Most local cable companies do not intervene in the day to day operations of the station.

c. Most affiliated stations do share the provided cable channel with another prgramming source. The affiliated station is the sole source of programming for a provided channel.

d. Stations which have advisory boards perceive those boards as being

inactive or having a low level of activity. Related to this finding, most station directors do not recognize a need for a more active board.
e. Most station directors believe that providing or doing public access programming benefits the overall operation of the cable station.

II. BUDGET PROBLEMS/STATEMENTS

a. Higher education administrators want and demand that the station provide more services than the administration is willing or able to provide budgetary support for.
b. Linkages with other cable systems, for programming acquisitions or for program delivery, were not evident. Related to this finding, there appears to be a limited return on investment.
c. Overwhelmingly, there does not seem to be a financial commitment from the cable company.

III. PERSONNEL PROBLEMS/STATEMENTS

a. Most station director's time is divided among other institutional responsibilities apart form direct station management. Related to this, most director's perceive that they are not given sufficient release time for station duties.
b. Most stations are highly dependent upon student assistants. Given a predominantly student work force, programming and general studio work/tasks are not preformed in a timely or professionally consistant manner.
c. There appears to be inadequate, ongoing, professional development for station directors.

IV. EQUIPMENT PROBLEMS/STATEMENTS

a. The data revealed that there is a consistent pattern of overutilization of equipment and a general feeling of insufficient stock of equipment. This is especially evident given the numbers of students involved at most stations.
b. A consistent finding was the statement by station directors of the inadequacy of their current physical plant. This was particularly emphasized given the rapid growth of programmatic needs and advancements in technology.
c. Current equipment or projected patterns of equipment purchasing is perceived to be below desired levels of quantity and particularly quality.
d. There appears to be little or no strategic planning for equipment update. In most cases equipment must be expensively maintained beyond its useful service life.

In summary, the findings indicate specific problems and issues which most higher education affiliated cable television stations must deal with. These problems and issues appear consistent across different sponsoring institutions and across station structure or size.

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A PROFILE ON CURRENT PROBLEMS OF COLLEGE AND UNIVERSITY CABLE AFFILIATED TELEVISION STATIONS

PURPOSE

The purpose of this questionnaire is to collect data on the status and problems of college and university affiliated cable television stations.

WHO SHOULD BE COMPLETING THIS QUESTIONNAIRE?

The Director, Coordinator, or day-to-day administrator of the cable station. By cable station we mean a facility that provides cablecasting to the college or university and the community.

FORMAT OF THE QUESTIONNAIRE

The questionnaire is broken into two parts. The first part helps identify some general demographic information about the cable station. The second part requests some specific information concerning the station and related problems. It also contains an opportunity for sharing some specifics not highlighted within this questionnaire.

It would be most beneficial if you answer all the questions and statements as best you can. You should proceed through the questionnaire in order from beginning to end. The questionnaire has been designed to not only solicit information from you, but also to provide a common base of knowledge and sharing as you work through the questionnaire.

SURVEY PARTICIPATION AND SHARING OF RESULTS

As part of the study, the principal investigator is willing to provide you a summary copy of the results should you desire to receive a copy.

Do you wish to receive a copy of the results (check)? ______Yes______No

If yes, please print or type this identification information-

Name: ______ __________ _____ ____________________

(Dr|Mr|Ms) (First) (M.I.) (Last)

Title:______________________________

Contact Address: ______________________________

____

____

______________ ______________ ______________

(City) (State) (Zip code)

Office Phone: (   )   -

PART I - GENERAL DEMOGRAPHIC INFORMATION

1.Complete name of college or university:______________________________

2.Please check which is applicable about your institution: ______ private ______ public

3.Overall enrollment (estimated): ____________undergraduate ____________graduate

Does your institution have continuing education (check):_____Yes_____No

If yes: What is the appproximate enrollment______________

4.Setting or location characteristics of the institution. Check one-

________urban (within the city limits of a major metropolitan center, 50,000 people)

________suburban (within one hour driving distance of a major metropolitan center)

________rural (having no major metropolitan centers within a one hour driving distance)

5.Fill-in the requested information:

The year cable station was founded:____________
The year station became affiliated with a cable company:____________
Is your station programming part of the basic cable fee (check & answer)-
________Yes_______No
If yes, what is the total monthy fee paid by subscribers. $__________
If no, what is the base monthy fee $____________
and what is the additional fee for your station's programming. $__________

6.What is the number of cable subscribers that
-can receive your stations programming (potential):_________________
-are receiving your stations programming (actual):_________________

7.Check one of the appropriate statements on channel reception:
_____Your station is received on one of the first 12 primary channels.
_____Your station is received on a channel number greater than 13.

8.List the professional organizations or associations that the television staff and or the station are members of:

	Please check: Individual	Station
____	_________	_______
____	_________	_______
____	_________	_______
____	_________	_______

PART II - ASSESSMENT OF: ORGANIZATION, BUDGET, PERSONNEL, AND EQUIPMENT

ORGANIZATION, BUDGET, PERSONNEL, AND EQUIPMENT

Section (A) - Description of the organization.

1.What is the mission of the station. Please indicate an estimated percentage given the below list of probable station missions; space has been permitted should additional missions need to be added.

_____% Instruction of students in cable technology
_____% Delivery of educational programming in support of institutional offerings
_____% Marketing or public relations for the institution
_____% Delivery of programming in support of community affairs
_____% Other:____
_____% Other:____
100 % Total

2.Please check any of the below areas which describe the type of instructional programming you may air.

_____offering of telecourses
_____development of supplemental student materials with your programming
_____offering of tutorial or remedial programming
_____capacity for live coverage, such as quest speakers or special events
_____enrichment programming, such as cultural events
_____other:____
_____other:____

3.Below is a list of problem areas in instructional programming. Circle your feelings as to the significance of these problems given your station. Add any comments for clarification of your responses (optional-specify).

0=no problem
5=a serious problem

0 1 2 3 4 5 lack of or no faculty support
specify:
0 1 2 3 4 5 lack of or no administrative support
specify:
0 1 2 3 4 5 lack of or no community support
specify:
0 1 2 3 4 5 inability to do cable instructional programming due to unions
specify:
0 1 2 3 4 5 inadequate funding for production of instructional programming
specify:
0 1 2 3 4 5 Other:____________________
specify:
0 1 2 3 4 5 Other:____________________
specify:
0 1 2 3 4 5 Other:____________________
specify:

4.Which best describes the the reporting relationship of the station (please check one).
____The station is dependent upon an academic unit of the institution.
____The station is attached to an academic unit but also has a wider institutional mission than classroom use alone.
____The station is an administrative unit of the institution.
____Other:____________________

5.Do you perceive a reporting relationship problem? Given the items below or by listing others you may perceive, circle your feeling as to the significance of these problems given your particular station. Add any comments for clarification of your responses (optional-specify).

0=no problem
5=a serious problem

0 1 2 3 4 5 Is it clear who assigns tasks?
specify:
0 1 2 3 4 5 Does the source of funding conflict with day to day workload?
specify:
0 1 2 3 4 5 Is the chain of command clear?
specify:
0 1 2 3 4 5 Other:____________________
specify:
0 1 2 3 4 5 Other:____________________
specify:
0 1 2 3 4 5 Other:____________________
specify:

6.Below is a list of relationship areas with the cable company. Circle your feeling as to the significance of these problems given your particular station. Add any comments for clarification of your responses (optional-specify).

0=no problem
5=a serious problem

0 1 2 3 4 5 quality control of programming:
specify:
0 1 2 3 4 5 upgrading of equipment
specify:
0 1 2 3 4 5 censoring of programming
specify:
0 1 2 3 4 5 specification on amount of programming hours
specify:
0 1 2 3 4 5 specification on times of scheduling
specify:
0 1 2 3 4 5 other:______________________________
specify:
0 1 2 3 4 5 other:______________________________
specify:

7.There are several issues regarding public access. By public access we mean the public ability or right to use the cable system to transmit programming (usually for a fee).

Do you provide public access.______Yes______No

8.Below is a list of problem areas that deal with public access. Circle your feeling as to the significance of these problems given your particular station. Add any comments for clarification of your responses (optional-specify).

0=no problem
5=a serious problem

0 1 2 3 4 5 conflict of interest between the institution and cable company
specify:
0 1 2 3 4 5 unprepared clients or users
specify:
0 1 2 3 4 5 overuse of facilities
specify:
0 1 2 3 4 5 other:______________________________
specify:
0 1 2 3 4 5 other:______________________________
specify:

Section (B) - Discussion of the critical issues of the organization.

Respondent Generated:
From the above description items on organization and the issues generated by the investigator, what other issues do you feel are significant given organizational considerations (optional).

____
____
____
____
____
____
____

ORGANIZATION, BUDGET, PERSONNEL, AND EQUIPMENT

Section (A) - Description of the budget.

1.What is the station's estimated total operating budget in a given fiscal year (12 months): $____________________

2.Given this total budget, indicate the percentage from each of the categories below, the source of these funds.

____% General College/University operating funds
____% General academic department operating funds
____% Special student fees
____% Outside user fees including grants and or contracts
____% Endowment or alumni contributions
____% Other:____
____% Other:____
100 % Total

3.Given the list below, circle your opinion on those budgetary problems which are representative of your particular station. Add clarification statements if needed (optional-specify).

0=no problem
5=a serious problem

0 1 2 3 4 5 lack of a commitment by the administration
specify:
0 1 2 3 4 5 University has insufficient funds
specify:
0 1 2 3 4 5 station lacks a fair share of existing funds due to budgeting policies
specify:
0 1 2 3 4 5 budget operations are dependent upon soft monies (grant & contract)
specify:
0 1 2 3 4 5 other:____
specify:
0 1 2 3 4 5 other:____
specify:
0 1 2 3 4 5 other:____
specify:

4.Does the cable company have any financial commitments to the cable station? ______Yes______No

If yes, check any appropriate commitments-

______staffing
______technical support
______equipment replacement
______other:____
______other:____

Do any of the above commitments cause difficulties? Please explain-

Section (B) - Discussion of the critical issues of budgeting.

Respondent Generated:

From the above description items on budgeting and the issues generated by the investigator, what other issues do you feel are significant to consider under budget (optional).

ORGANIZATION, BUDGET, PERSONNEL, AND EQUIPMENT

Section (A) - Description of personnel.

1.Could you please identify the number of FTE (Full-time equivalent; 1.0=one person working full-time for one year) which directly report to you for the following categories:

______FTE professional staff
______FTE graduate students
______FTE undergraduate students
______FTE technical support staff
______FTE other:____________________
______FTE other:____________________

Could you please identify the personnel you have access to but reports to another administrative or academic unit.

_____FTE other:____________________
_____FTE other:____________________
_____FTE other:____________________

2.From the below list please identify the amount of input the following personnel have in long-range planning.

0=perceived as a person having no input
5=a great deal of input

0 1 2 3 4 5 advisory board
0 1 2 3 4 5 department chair or administrative head
0 1 2 3 4 5 station manager
0 1 2 3 4 5 university or college officials
0 1 2 3 4 5 cable company
0 1 2 3 4 5 other:____________________
0 1 2 3 4 5 other:____________________

3.Below is a potential list of personnel problems you may be experiencing. Circle your opinion on those personnel problems which are representative of your particular station. Add clarification statements if needed (optional-specify).

0=no problem
5=a serious problem

0 1 2 3 4 5 inactive advisory board
specify:
0 1 2 3 4 5 inadequate technical support
specify:
0 1 2 3 4 5 directors time not totally devoted to station operations
specify:
0 1 2 3 4 5 heavy reliance on students for daily operations
specify:
0 1 2 3 4 5 inadequate professional staffing
specify:
0 1 2 3 4 5 inadequate ongoing professional staff development
specify:
0 1 2 3 4 5 other:____________________
specify:
0 1 2 3 4 5 other:____________________
specify:

Section (B) - Discussion of the critical issues of personnel.

Respondent Generated:

From the above description items on personnel and the issues generated by the investigator, what other issues do you feel are significant to consider under personnel (optional).

____
____
____
____
____

ORGANIZATION, BUDGET, PERSONNEL, AND EQUIPMENT

Section (A) - Description of equipment.

1.Below are simple yes/no statements to quantify and qualify your facilities. Check off the appropriate response.

______Yes______No -Does the station have a production studio?
______Yes______No -Does the station have color capability?
______Yes______No -Does the station have remote equipment?
______Yes______No -Does the station have editing capability?

2.Please fill-in or check the appropriate blanks in helping us to define your equipment.

VCRs: Quantity________ Formats____
Audio console: Yes________ No_______
Film chain capablities: 16mmm_____ 8mm_____ 35mm slides______
Character generator: Pages of memory_______
Cameras: Number of studio______ Number of remote______
Time base corrector: Yes______ No______
Video switching capabilities: Yes______ No______

3.Given the mission of your station, identify the equipment problems that your station may have. Add clarification statements if needed (optional-specify).

0=no problem
5=a serious problem

0 1 2 3 4 5 important equipment components are missing from a desired system
specify:
0 1 2 3 4 5 quality of equipment is not at desirable level
specify:
0 1 2 3 4 5 more of existing equipment (quantity) is desirable
specify:
0 1 2 3 4 5 equipment is outdated
specify:
0 1 2 3 4 5 inadequate physical plant and facilities
specify:
0 1 2 3 4 5 inadequate maintenance of equipment
specify:
0 1 2 3 4 5 other:____
specify:
0 1 2 3 4 5 other:____
specify:

Section (B) - Discussion of the critical issues of equipment.

Respondent Generated:
From the above description items on equipment and the issues generated by the investigator, what other issues do you feel are significant to consider under equipment (optional).

Selecting Media for Instruction

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Running head: Selecting Media

Abstract

The effects of instruction in using a formal media selection procedure on the media selection choices made by novice instructional designers is examined. An informal intuitive selection procedure is compared with instruction (information, practice, and feedback) using a formal media selection procedure developed by Reiser and Gagne (1983). Results indicate that students who use the media selection model make more correct decisions than when they don't use the model. Also, students often do not use the model correctly, but the redundancy in the model and the restricted choices available increase the probability that a correct choice will be made.

Selecting Media for Instruction

Most formal media selection procedures are designed to assist developers in the selection of the appropriate medium to use in a given instructional situation. Higgins and Reiser (1985) reported that subjects who read a review of the characteristics of media selection models (Reiser and Gagne, 1982) and a description of how to use the Reiser and Gagne (1983) model for media selection were more likely to make media choices which matched those of experienced instructional designers. However, because of the relatively low percentage of students who made correct media selections, the investigators questioned the adequacy of the orientation the students received to the media selection model. The current study presents students with additional information, practice and feedback in using the model.

Method

Subjects

Twenty-nine male and female graduate students enrolled in a media design course at Arizona Sate University during the fall semester, 1985, participated in the study.

Materials

Four of the media design problems developed by Higgins and Reiser (1985) were used in this study. The problems were written descriptions of various instructional situations in which an instructional presentation had to be developed. Each problem involved a different content area, a different type of learning outcome, and a different instructional setting. The problems were entitled Personnel Interviewing, Aircraft Instrument Comprehension, C.T. Scan, and Instructional Objectives, each title reflecting the subject matter of the instructional program to be designed.

Each problem included information about the purpose of the instruction and specific instructional objectives. The problems also included descriptions of the instructional setting, the intended audience, the media budget available, and the instructional functions of the media to be selected.

Each media selection problem had a designated "correct" medium for use in that situation. These correct media choices were identified by two experienced instructional designers using the Reiser and Gagne media selection model.

Procedures

The participants selected media under two conditions: an informal intuitive condition and a formal media selection condition. The C.T. Scan, Personnel Interviewing, and Aircraft Instrument Comprehension problems were randomly assigned to the students under the intuitive condition. Students were directed to read the problem, select the most appropriate media or medium, and write a brief rationale for their selection. No feedback was given on the appropriateness of their media selection.

Following the intuitive condition, students were instructed to read the review by Reiser and Gagne (1982) and the material by Reiser and Gagne (1983) describing how to use the Reiser and Gagne media selection model. Students were directed to read the articles during the next week and use the formal model to make a media selection for the Instructional Objectives problem. They were asked to record the step-by-step decisions they made while working through the model, and to record the amount of time required to study the readings and use the model, and again were asked to write a brief rationale for their decision.

At the end of the week, the correct answer as well as the rationale behind its selection was discussed in class. Questions regarding the use of the model were answered. At the end of class, students were assigned to the C.T. Scan, Personnel Interviewing, or Aircraft Instrument Comprehension problem, such that each student was systematically assigned a different problem than in the intuitive condition. They were instructed to work through the problem as in the practice, and they were informed that this was one of six graded assignments that would be used to determine their course grade.

Results

In the intuitive condition, 36% of those students with the C.T. Scan problem and 55% of those with the Personnel Interviewing problem made the correct media selection. None of the students assigned the Aircraft Instrument Comprehension problem made the correct media selection. A total of 32% of the students made the correct media selection decision. These data are summarized in Table 1.

After reading the materials and working through the media selection model with the Instructional Objectives problem, 55% of the students made correct media selections. However, 56% of those who made correct selections did not work through the model properly. Seventeen percent of the students used the model properly but made an error in final media selection. Fourteen percent of the students neither used the model properly nor made the correct final media selection decision. These data are summarized as Table 2.

In the final, test condition, students again used the model to select media for one of the instructional problems, but this time they were told that their performance would count as part of their grade. Of the 29 students, a total of 28 (96%) made the correct media selection, but only 40% of those who made correct media selections also used the model correctly. This information is presented in Table 3.

Discussion

Performance in the intuitive condition indicates that selecting media for given problems is fairly difficult, since only 32% of the students made the correct media selection. It can also be inferred from the differential performance on the media selection problems in the intuitive condition that the problems vary in difficulty. None of the nine students who were assigned the Aircraft Instrument Comprehension problem were able to make the correct media selection intuitively, although 36% of those attempting the C.T. Scan problem and 55% of those attempting the Personnel Interviewing problem were able to make correct selections

After practice and self-instruction in use of the Reiser-Gagne media selection model, students are able to make correct choices more often. This may be partially due to the redundancy built into the model, since the same media choices appear in several of the final choice boxes in the flowchart. Performance in the practice condition also indicates that students are unable to use the model effectively based upon reading alone.

Performance in both the practice and test conditions indicates that the model is fairly difficult to use. Only 24% of the students in the practice condition and 40% in the test condition were able to use the model correctly to make the correct media selection. However, in the test condition 96% of the students made the correct media selection, This again indicates that the redundancy within the model helps to restrict media selections, even though it is used incorrectly. It can also be seen that students get better at using the model correctly as they gain experience.

It can tentatively be concluded from this study that students who use the Reiser-Gagne media selection model make more correct media selection decisions than when they don't use the model. Also, students often do not use the model correctly, but the redundancy in the model and the restricted choices available increase the probability that a correct choice will be made.

References

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Reiser, R., & Gagne, R. (1982). Characteristics of media selection models. *Review of Educational Research*, *52*(4), 499-512.

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Table 1

Intuitive Media Selection Procedure: Proportion of Students Making Correct Media Selections

	Media Selection Problem Assigned		
	C.T. Scan	Personnel Interviewing	Aircraft Instrument Comprehension
Correct Media Selected	4 (36%)	6 (55%)	0 (0%)
Incorrect Media	7 (63%)	5 (45%)	9 (100%)
Totals	11	11	9

Table 2

Reiser-Gagne Model Use: Practice (Instructional Objectives Workshop Problem) - Proportion of Students Using Flowchart Properly and Making Correct Media Selections

Correct Model Use/ Correct Media Selection	7 (24%)
Incorrect Model Use/ Correct Media Selection	9 (31%)
Total Correct Media Selection	16 (55%)
Correct Model Use/ Incorrect Media Selection	5 (17%)
Incorrect Model Use/ Incorrect Media Selection	4 (14%)
Unable to complete assignment	4 (14%)
Total	29

Table 3

Reiser & Gagne Model Use: Test

	Media Selection Problem Assigned*		
	C.T. Scan	Personnel Interviewing	Aircraft Instrument Comprehension
Correct Model Use/ Correct Media Selection	3 (30%)	7 (60%)	1 (12%)
Incorrect Model Use/ Correct Media Selection	6 (60%)	4 (36%)	7 (88%)
Total Correct Media Selection	9 (31%)	11 (38%)	8 (27%)
Correct Model Use/ Incorrect Media Selection	1 (3%)	0	0
Incorrect Model Use/ Incorrect Media Selection	0	0	0

* n=29

Feasibility Study of Bulletin Board and Electronic Mail Technologies for the Improvement of Student/Instructor Communications Used in "Distant" Education Course Offerings

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INTRODUCTION

What is the problem?

Responding to direction from the Board of Regents, the College of Education at the University of Georgia has entered into several cooperative programs to offer advanced graduate degree programs in the south Georgia area. While these programs are meeting very real needs for students in that area, they are causing more than ordinary time demands of the UGA professional staff. Any technology that can reduce this nonproductive use of the instructor's time while maintaining or increasing the interaction between instructor and students warrants further study and investigation.

What is the specific context of the problem?

Since the spring of 1982, the College of Education at the University of Georgia has operated a doctoral program for health professionals on the campus of Armstrong State College in Savannah, Georgia. The program, which allows students to pursue the Doctorate in Education (Ed.D.) in the areas of curriulum or instructional development, was designed especially for health professionals who are involved in education or training.

The opportunity to receive their doctoral instruction at the local campus gives students several unique advantages. First, they avoid the turmoil, both to their careers and to their families, of relocating in Athens. They continue with their present jobs, attending class during late afternoon and night. Second, they avoid the expense of moving to another town and of losing the income from their present jobs. Third, they have the singular opportunity to apply what they are learning immediately to their jobs.

Operating a doctoral program so far away from the UGA campus in Athens, however, poses special problems for faculty and students. For the faculty, the most obvious problem is travel. By car, travel from Athens to Savannah requires about four and a half hours. Since classes begin in the late afternoon, faculty must stay overnight. So a class in Savannah requires UGA faculty to spend two workdays away from campus. In addition to the problem of physical distance, faculty must cope with the reduced opportunity to work and communicate with students. The College of Education and its faculty, then, face several problems: increased expenses due to faculty travel, loss of productive faculty time in travel, and reduced opportunities to interact with students.

Students also encounter problems in pursuing their doctoral studies away from the UGA campus. Library resources are not always readily at hand, nor is the friendly advice and presence of other doctoral students familiar with the program and with the professors who teach in it. The faculty themselves are encountered one at a time with little opportunity for additional contact during the week.

What is the purpose of this study?

The purpose of this study was to examine the process of introducing, maintaining, and using an innovation, the electronic bulletin board, within the off-campus doctoral program at Armstrong State College. In particular, we wanted to conduct the study within a specific classroom setting, addressing several questions:

1. What are the students' current levels of experience with computers?
2. Will they voluntarily choose to use the electronic bulletin board?
3. How do they evaluate its effectiveness?
4. How do we evaluate its effectiveness?
5. What modifications can we make to improve its continued use?

METHOD

Who were the participants?

Fourteen doctoral students enrolled in an advanced course, Research in Instruction, participated in this study. Students were employed, primarily as educators, in the health fields such as nursing, dental hygiene, and radiological technology. They have been enrolled in this program for approximately four years and have taken, for the most part, the same sequence of course work. The group consisted of thirteen females and one male, and ranged in age from 30 to 52.

What was the context of the study?

A doctoral program of study involves several distinct phases: (a) taking course work; (b) passing preliminary written and oral exams; (c) developing a dissertation prospectus; (d) conducting the study; (e) writing up the results; and (f) obtaining approval of the dissertation via a reading committee and final oral exam. Students in this study were at level (b) the quarter during which the electronic bulletin board was introduced. They were anticipating standing the written and oral preliminary exams. In other words, they were moving from the familiar pattern of taking courses to the unfamiliar and anxiety producing stage of the preliminary exams. In short, the electronic bulletin board was introduced at a very stressful time for the students.

Second, the course being offered (Research in Instruction) did not follow the typical pattern of students receiving instruction each week, taking quizzes, preparing papers, and so forth. Rather, this course allowed each student to work independently to prepare for the preliminary exams. A different type of instructional strategy, then, was needed. Communication between students and faculty, rather than formal study, was required.

Third, the use of the bulletin board was voluntary. It was presented as a useful tool for facilitating communications between students and faculty. No one was required, for example, to sign on or post a specified number of messages.

Fourth, as one might expect, some students were familiar with using personal computers, others were not. Some students owned personal computers, modems, and communication software, others did not. This information will be described later.

What did we do?

We conducted two major activities: installed and monitored the electronic bulletin board and provided a training session on the use of the system. Each of these activities is described below.

Installation and Monitoring

A Tandy 1200 (640K and a 10 megabyte hard disk) was installed in the Armstrong Department of Nursing, connecting the computer via modem to one of the departmental phone lines. We had previously tested the operation of this computer by running a campus bulletin board on it for a two-week period.

The software package used was the Remote Bulletin Board System for the IBM Personal Computer or, as it is more commonly known, the RBBS-PC. This program was developed and still maintained by the Capitol PC User Group in Gaithersburg, Maryland. The RBBS-PC package is copywrited but is available at no cost. For a modest contribution of twenty-five dollars to the Capitol PC User Group, a user will be registered and notified of further improvements in the package.

The major features of the RBBS-PC are a message system, a bulletin system, and a filing system. The message systems allows 250 active messages, which may be private or available to anyone. The bulletin system is operated only by the system operator and contains announcements or other information that is permanently posted. The filing system allows the uploading and downloading of text documents or programs. RBBS-PC also has an option for assigning different levels of security for users, which increase or decrease the user's access to the entire package.

A special program was written to initialize the RBBS program immediately when the computer was turned on so with the flip of a switch the system was ready for use. The system initialized and was then ready. The board operated from 5:00 PM to 9:00 AM weekdays and 24 hours a day on weekends.

The logic of placing the host computer in Savannah was that it required only local calls for students. We would call long distance on GIST from Athens, thereby assuming the major phone expense. The system, then, had to be monitored remotely from Athens, which was a disadvantage to the system operator.

Training Session

A two-hour training session was held during the second class meeting of fall quarter, 1985, on the same day that the computer was installed. Students met one of our two systems operators, a graduate student enrolled in the on-campus program in instructional development, who then demonstrated the major features of the RBBS package. An eleven-page description of the program was distributed. Major topics included signing on, the help file, reading messages, leaving a message, the utilities menu, the files system.

At the time the training session was conducted, an informal survey of students indicated that seven out of the eleven present owned a personal computer. Five students owned modems and communications software; four had placed calls to an electronic bulletin board or electronic mail service. We made arrangements for a TRS Model 100 computer, an inexpensive yet adequate computer with a built-in modem, to be made available for each student who did not own or have access to a computer.

What data did we collect?

Students knew generally that we would collect data at the end of the quarter on the operation of the system and on their reactions to this experience. Upon further reflection, however, we concluded that this informal approach was unfair to the students. They should know very specifically what data we would collect, how it would be collected, who would do it, and what use would be made of the data. We therefore developed a consent form that clearly explained our intentions. Two major items from this form are given below.

> The following points have been explained to me:
>
> 1) The reason for the research is to assess the feasibility and effectiveness of the electronic bulletin board as a communication tool in our off-campus doctoral program. The advantages that I may expect from it are: (a) insures that specific problems you may encounter when using the bulletin board are addressed, (b) provides a systematic record of your reactions to the bulletin board, (c) insures effective use of the board with future classes, (d) models action research dealing with use and acceptance of an innovation.
>
> 2) The procedures are as follows: (a) You will be asked, via interviews and/or self-report, to describe your level of use of the bulletin board, problems you encountered, and conditions that would make it a more effective communication tool. This information will be collected once each quarter. (b) You will also be asked, via a questionnaire, to share your concerns about this innovation. For example, -Do you need more information about it? Would you prefer to use a different way of communicating? This information will be collected once each quarter. (c) Data will be collected over a three quarter period. (d) Statistics on use and operation of the board will be kept. In no circumstance, however, will the content of a message be a part of this study. Your messages will receive the level of security that you assign and will not be seen by anyone other than the person or persons you designate and the systems operator.

Students read the consent form, asked for a few clarifications, and then all eleven present at the last class meeting signed the consent forms.

As item 2 in the consent form shows, three types of information were obtained: (a) self-report about their level of use of and reactions to the bulletin board; (b) response to a questionnaire about their concerns about the bulletin board; and (c) statistics on the use of the bulletin board, which came directly from the RBBS program.

The self-report form consisted of nine items requesting such information as "3. Did you have any problem(s) in using the Bulletin Board?" and "6. Should the Bulletin Board be continued next quarter?"

The Stages of Concern Questionnaire (SoCQ) developed by Hall, George, and Rutherford (1979) was the questionnaire used to measure students' concerns about the bulletin board as an instructional innovation. Hall et al. make two major assumptions about the individual adopter: first, that individuals move through seven stages of concern about the innovation, and second, that the intensity of concerns varies from stage to stage. For example, a person who is a "non-user" of an innovation would have a different profile of concerns than a "user." Moreover, the non-user profile would change as that individual becomes an experienced user.

Broyles and Tillman (1985, p. 366) described the seven specific stages of the SoCQ as follows:

0	Awareness	Little concern or involvement with the project.
1	Informational	Need for general information.
2	Personal	Uncertainty about her/his role in the project.
3	Management	Attention to the processes and task of using the project.
4	Consequence	Focus on the impact of the project on the learner.
5	Collaboration	Focus on coordination and cooperation with others regarding the project.
6	Refocusing	Exploration of alternative uses of the project or a replacement.

What did we find?

In reviewing the findings presented below, several important features of this study should be kept in mind. First, the introduction of the bulletin board came at a very stressful time for students, taking preliminary written and oral examinations. While students generally welcomed it as a useful tool, it was clearly adjunctive or, for a few students, unnecessary at that moment. Second, the use of the bulletin board was purely voluntary. No minimum number of sign-on's were required. Third, at the time the host computer was installed, only five students had the necessary hardware to link up with the system. Although we would have preferred that all students have the necessary equipment at the start of the quarter, this could not be achieved without delaying the installation of the host computer. By the end of the quarter, most students did have access to the bulletin board. In several cases, the availability of the board prompted students to purchase their own personal computers.

Findings are presented in four sections: summary of RBBS usage, self-report results, responses to the SoCQ, and initial costs.

Summary of RBBS Usage

The number of times each user signed on the RBBS over a ten week period from October to December can be summarized as follows:

Person	Number of times signed on
Sysop 1	15
Sysop 2	11
Instructor	13
Student 1	41
Student 2	11
Student 3	10
Student 4	5
Student 5	2
Student 6	1
Student 7	1
Others	5

These data show very clearly that only half of the students signed on the bulletin board during fall quarter. "Others" were callers who were checking out the new board. No files were uploaded or downloaded.

Self-Report Results

A survey of RBBS usage was given during the last class meeting. Eleven of the fourteen students were present. Of those eleven, six had used the board and five had not. When asked "Why did you not use the board?" four replied "lack of equipment" and one "didn't know how." Three of the four who lacked equipment also mentioned that they did not need the board that quarter.

Of those who used the board, a variety of problems were encountered: (1) one student was tagged with a security violation and access was then withheld (apparently the student repeated an incorrect command three times so the RBBS program decided a criminal was at work); (2) several attempts to upload and download files were unsuccessful; (3) use of nicknames in addressing messages would result in undelivered messages; (4) a user would be knocked off the board automatically after two minutes of inactivity; (5) occassionally, the computer would not be turned on at 5:00.

Also from those who used the board, several suggestions for improvement in the system were obtained: (1) increase access time by having a separate phone line; (2) train other University of Georgia faculty in the use of the board; and (3) post more information of general interest to all.

And finally, students were asked two specific questions: (1) "How frequently do you plan to use the board next quarter?" Eight replied "more than this quarter" and two "about the same." (2) "Should the board be continued next quarter?" Ten replied "yes"; one record was incomplete.

Responses to the Stages of Concern Questionnaire (SoCQ)

Eleven students completed the SoCQ. For each record, raw scores for the seven stages were converted to percentiles, then plotted. Two groups of student records were formed. One consisted of the three most frequent users of the bulletin board. The other consisted of five students who did not use the board. Profiles of these groups were averaged, plotted, and then compared. The resulting profiles conform to the predictions of the concerns model: the nonuser group of five showed very high intensity of concerns in the first three stages (awareness, informational, and personal) with less intense concerns for the four remaining stages. Their concerns, then, were in obtaining more information and in determining how they might use the bulletin board; they were not concerned about collaborating with colleagues about the bulletin board. The user group, however, showed a different pattern of concerns: lower awareness, informational, and personal but much higher on collaboration. This user group had yet to show concerns for refocusing, which the concerns model would predict for experienced users. In short, concerns theory appeared to describe quite well the two user groups that we formed.

Our primary use of this data, however, was to develop an appropriate intervention for each student based on his or her unique profile. These data will also be shared with students. The SoCQ will also be given at the end of winter and spring quarters.

Initial Costs

Our original projection for equipment called for a budget of $9,600, which included one Tandy model 1200 with accessories, ten model 100 portable computers, and one printer. Our actual equipment expenses, however, were these:

1	Tandy 1200 HD with monitor, graphics adapter, and cables	$2,295
1	Modem	350
3	Model 100 (24K) with cables, carrying cases, and AC adaptor	1,555
	Total	$4,200

The system operator's salary for the quarter would add an additional $1,000 to this total (10 hours per week at $10 per hour for 10 weeks) as well as the GIST phone calls to Savannah, estimated at $150 (GIST does not provide actual cost billing). The total expenses then add up to $5,350. This figure does not reflect any equipment costs from the Athens end. We already had the needed equipment. Additional improvements, such as a printer in Savannah and a dedicated phone line, will of course increase this figure.

We did not project any sort of cost benefit ratios since most of this quarter was devoted to installing the system. With additional experience in operating the system, we will examine carefully this important dimension.

Where do we go from here?

Our initial view of establishing a bulletin board focused on equipment, budget, and logistical problems. And indeed, it took virtually the entire quarter to develop an operational system, including installation and monitoring the system, training students in its use, and procuring equipment so students can have access to the system. On this score, we have simply just begun. We have an operational system, but one that is not functioning well for all its potential users. Only half of the students have actually used the system.

After ten weeks of operation, however, we have become more aware of the student's view of the system. Some students, for example, need additional practice in using the basic system. Yet others, want to share information about the bulletin board with colleagues and locate and use additional bulletin boards in their specialty areas. Also, more linkages, for example, need to be made between Armstrong State students and University of Georgia faculty and students.

We are encouraged that the students themselves, those who have used the system and those who have not, strongly support the continued operation of the bulletin board. Both they and we remain optimistic that a significant new communication tool is being forged.

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The Accuracy of Cognitive Monitoring
During Computer-Based Instruction

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ABSTRACT

In order to individualize instruction, computer-based lessons often allow the learner to determine which material will be covered, and the sequence to be followed. Unfortunately, subjects who control their instructional decisions often perform worse than subjects under program control. This study examined the relationship between self-assessed understanding of lesson content and performance on factual and inferential test questions among 50 college undergraduates. Analysis showed little or no correlation between ratings of understanding and subsequent preformance on both embedded questions and a posttest. This apparent inability to accurately assess understanding may help to explain why subjects who control their own instructional decisions tend to terminate instruction prematurely.

THE ACCURACY OF COGNITIVE MONITORING DURING COMPUTER-BASED INSTRUCTION

Individuals process information in different ways. The strategies preferred by one learner are likely to differ from those preferred by another. Ideally, every lesson should be individually tailored to suit the needs and abilities of each learner "so as to develop, compensate for, or capitalize upon student characteristics for the optimization of subject-matter learning" (Messick, 1984, p. 69). One way to accomplish such individual tailoring is by transferring control of the lesson's structure and sequence to the learner. The greater the learner control, the more individualized instruction should become.

Unfortunately, research in this area has failed to demonstrate that learner control consistently improves learning. Instead, studies indicate that imposed control increases learning significantly over programs in which the learner controls the instructional scope and sequence (See, for example, Atkinson, 1972; Park & Tennyson, 1983; Ross & Rakow, 1981; Tennyson, Tennyson & Rothen, 1980; Tennyson & Buttrey, 1980; Tennyson, Christensen & Park, 1984). Tennyson (1980, p. 505) stated that "instructional research dealing with variables of learner control has failed to demonstrate that students can make and carry out decisions of content element selection and personal learning assessment."

A basic problem noted by locus on instructional control researchers has been that subjects who controlled their instruction frequently terminated instruction prematurely. However, the cause of this phenomenon is not clear. If subjects who control instruction direct as much effort to learn as those under program control, then other factors must affect instructional control decisions.

One possible explanation is that many learners do not assess accurately their understanding of lesson information. Less skilled learners, and perhaps learners who encounter new subject matter, tend not to detect their failure to understand new material (August, Flavell & Clift, 1984; Baker, 1979; Flavell, 1979; Garner, 1981; Garner & Anderson, 1982; Grabe & Mann, 1984; Markman, 1977; Robinson & Robinson, 1984; Whimbey, 1976).

If instructional control decisions are made based upon accurate student comprehension monitoring, successful outcomes should be expected; if based upon monitoring that is ineffective, however, the outcomes of learner-directed lessons are likely to be poor. The accuracy of student comprehension monitoring, therefore, is a critical variable in learner-directed computer-based instruction.

Deese (1969) suggested that understanding is an introspective process that each person is capable of recognizing. This is supported by Hart's (1967) work demonstrating that perceptions of comprehension were very accurate when compared with a subsequent recognition posttest. Several studies, however, contradict Deese and Hart's hypotheses, indicating that learners are not always good judges of their understanding (August, Flavell & Clift, 1984; Baker, 1979; Bransford & Nitsch, 1978; Brown, Campione & Barclay, 1979; Garner & Anderson, 1982; Goetzfried & Hannafin, 1985; Markman, 1977; Robinson & Robinson, 1984; Whimbey, 1976). In these studies subjects either thought they understood or ignored their lack of comprehension during instruction.

The types and levels of learning are also likely to influence both self-assessment and en-route comprehension. Numerous studies have shown that main ideas are better remembered than details (Britton, Simpson, Meyer, Holdredge & Curry, 1979; Johnson, 1970; Kintsch, 1974; Kintsch & Keenan, 1973; Meyer, 1975; Meyer & Rice, 1981; Walker & Meyer, 1980). It may be the understanding of these main ideas upon which subjects base self assessments. Meyer and others developed a system for identifying the level of propositions in text, and concluded that information high in the structure (main, or superordinate ideas) is more likely to be integrated into the learner's cognitive schema than information low in the structure (details, or subordinate ideas).

In this study the accuracy of student's comprehension monitoring during computer-based instruction, and the relationship between enroute monitoring and different levels of learning, were studied.

METHODS

Subjects

The subjects were 50 university undergraduates enrolled in an introductory educational psychology class at a large public university. Subjects participated in the study on a voluntary basis and were awarded extra credit for their participation.

Materials

The lesson concerned the discovery of a fictional ore (berkelium oxide) on an imaginary South Seas island. Although the details of the material were fictitious in order to avoid the influences of prior knowledge, the content was designed to avoid logical conflicts with concepts pertaining to history, economics, anthropology, and mineral science.

The information was divided into four sections and presented in the form of computer-based instruction. The four sections were ***The History of Jexium Island, The Discovery of Berkelium Oxide, The Mining of Berkelium Oxide***, and ***The Market for Berkelium Oxide***. The average number of frames per section was 11 with a maximum of 13 and a minimum of 10. Each section also contained two graphic drawings which were used to maintain motivation, but did not relate to items later tested. The material was designed to include a high information density within individual frames and sections in order to require students to sort among numerous facts and concepts.

Following each section, students were asked to rate their level of understanding of both the factual and inferential material on scales from one (not at all) to five (very well). They then answered eight short-answer embedded questions pertaining to the material. The eight embedded questions consisted of four factual questions and four inferential questions. Questions following each section covered only information presented in that section and were not cumulative.

Factual Lesson Content

Factual questions were those which required the recall of information which had been stated explicitly in the text. The questions were divided into three levels, based on elements common to the parsing hierarchies of both Meyer and Kintsch. The system used was considered more appropriate for the individual frames of computer-based instruction. Factual questions were divided into three Level 1 questions, eight Level 2 questions, and five Level 3 questions.

Level 1. Level 1 questions were the most general and could be answered with the main idea of a computer frame. An example of a level 1 question is: "What was the ore Groningen discovered?"

Level 2. Level 2 questions were more specific and required information which supported the main ideas. An example of a level 2 question is: "Why was the discovery of the ore important to laboratory scientists?"

Level 3. Finally, level 3 questions were the most specific and covered details which were less significant to the main ideas of the story. An example of a level 3 question is: "In what decade did Groningen go to Jexium Island?"

Inferential Lesson Content

Inferential questions required students to evaluate two or more related pieces of information in order to form a conclusion. The questions were divided into intraframe and interframe inferences. Intraframe and interframe inferential questions were distributed evenly across sections.

Intraframe. Intraframe inferences could be answered based upon information presented in a single frame. An example of an intraframe question is: "What important event occured on Jexium Island in 1945?"

Interframe. Interframe inferences required that information from two or more frames be evaluated simultaneously in order to form an appropriate inference. An example of an interframe question is: "Who built the towns around the mine site?"

Lesson Posttest

There were a total of 32 items on the posttest: half were repeated from the lesson and half were new items. The information tested using the new questions was evenly divided across the four sections and contained equal numbers of factual and inferential questions. Sixteen of the questions were factual and 16 were inferential, yielding four learning measures: Repeated Facts, New Facts, Repeated Inferences, New Inferences. One-half of the inference questions were interframe and the others were intraframe questions. Three of the factual questions were Level 1, seven were Level 2, and six were Level 3. The items were presented in random order. All test items were short-answer type questions.

Dependent Measures

Several dependent measures were collected. Dependent measures related both to students' ratings of their understanding and to their subsequent performance on both embedded and posttest questions were collected.

Separate measures were obtained for fact and inference ratings for each of the sections of the lesson. In addition, the number of correct responses to embedded factual and inferential questions was computed, as well as an aggregated fact and inference score for the lesson.

Student performance on the posttest was organized in two ways. First, correct answers were tallied to produce a fact and an inference scale. Next, factual items were classified as Level 1, Level 2, or Level 3, and inference items were classified as Interframe or Intraframe.

Design and Data Analysis

The design was a complete repeated measures design, where all participants received exactly the same instructional treatment. All dependent measures were gathered on all students. Regression procedures were conducted to determine the predictive value of en-route self-assessments for corresponding factual and inferential learning both for the embedded and the posttest questions.

Enroute ratings for factual understanding were used to predict student performance on embedded factual questions while enroute ratings for inferences were used to predict student performance on embedded inference questions. Enroute ratings were also used to predict posttest performance for each corresponding scale. In addition, enroute ratings were intercorrelated in order to examine the relationship among ratings for facts or inferences.

Procedures

All students received the same treatment. Students reported to a microcomputer lab during one of eight periods reserved specifically for the study. They were told the study was designed to investigate how well people understand material presented via computer, what they understand, and how well they can evaluate their own understanding. They were also told that the lesson consisted of four parts with approximately 10 frames of information contained in each section and that they would be asked short answer questions over the material after each section. This information was given orally at the beginning of each session and also repeated at the beginning of the lesson. Since student input was recorded during the computer program, students were told not to be concerned with correct spelling, but to confine answers to a single line. No time limit was imposed for responding to the questions.

Students then completed the lesson. During each section they viewed the lesson and answered the eight embedded questions. Students did not receive any knowledge of their results on these questions. Following all four sections, the 32 item posttest was completed.

RESULTS AND DISCUSSION

Factual Ratings with Performance

Factual ratings correlated with embedded scores. Table 1 contains correlations between students' ratings of their factual understanding and their scores on the factual questions following each section of the lesson. Summed across sections, the total factual ratings and performance on factual embedded questions were correlated at .30 ($p < .05$). However, most of this correlation could be accounted for by performance on the fourth section. During the first three sections, the correlations between ratings and performance were not significant. Only during the fourth section were ratings and scores on factual questions significantly correlated at .30 ($p < .05$).

Insert Table 1 about here.

This could indicate that students improved in their ability to rate understanding as a result of the embedded questions. However, although the most accurate predictions were made in the fourth section, the effect was not progressive during the first three sections.

Intercorrelations among factual ratings. Table 2 contains correlations between ratings of factual understanding in each of the four sections. Factual ratings were intercorrelated fairly well (minimum $p < .01$), indicating that students use an internally consistent system to rate their understanding of factual information, but that the system was not as highly related to their actual knowledge of the information tested.

Insert Table 2 about here.

Correlations were generally highest as students progressed chronologically. Self ratings for Section 1 correlated more highly with ratings for Section 2 (.55) than with ratings for later sections. Ratings for Section 3 correlated highest with Section 4 (.59). This might indicate that adjustments in assessing understanding were made gradually as students progressed through the lesson, modifying their criteria for judgement based on experience obtained during the lesson.

Factual ratings correlated with posttest scores. Table 3 contains correlations between enroute ratings of factual understanding and posttest scores on questions from each of the four sections. Although students performed approximately as well on the posttest questions as on the embedded questions ($r = .72$, $p < .0001$), correlations between ratings and scores were generally lower than during the lesson and were even negatively correlated in some instances.

Insert Table 3 about here.

Factual ratings correlated with levels of factual questions. Table 4 contains correlations between ratings and performance on the three levels of fact questions. Because levels were not evenly distributed among sections and there were only a few examples of each level within a section, total scores are used.

Insert Table 4 about here.

The only significant correlations were found between Section 1 ratings and performance during the lesson for each level. These correlations are also reflected in the overall correlation between Section 1 ratings and total score shown in Table 1. The general consistency across levels, especially as seen in the total ratings correlated with levels, may indicate a consistency in ratings across levels of information. The slightly lower correlations for Level 1 questions throughout may be accounted for by the fact that there were simply fewer Level 1 questions. Although correlations with Level 3 questions on the posttest were slightly higher than for the other two levels, they were generally not significant.

Inference Ratings with Performance

Inference ratings correlated with embedded scores. Table 5 contains correlations between ratings of inferential understanding and scores on the embedded inference questions. Summed across sections, the total inferential ratings and performance on inferential embedded questions were correlated at .38 ($p < .01$). As with the factual correlations, however (see Table 1), most of this could be accounted for by performance on later sections. The general trend for correlations between ratings and performance on individual sections was similar to the trend found for factual questions. Initially, correlations were low, but in section three ratings and performance were significantly correlated at .37 ($p < .01$). However, correlations declined in Section 4.

Insert Table 5 about here.

Intercorrelations among inference ratings. Table 6 contains correlations between students' ratings of inferential understanding in each of the four sections. In all but one instance (Section 3 with Section 1), ratings were significantly intercorrelated. The correlation among inference ratings was greater than for performance on either embedded or posttest inference questions. Again, this suggests that students use an internally consistent system to rate their understanding but that this system is not related favorably to tested knowledge.

Insert Table 6 about here.

Inference rating intercorrelations exhibited the same general trends as factual rating intercorrelations. This trend may indicate that students modify their criteria for self-assessment based on lesson experiences. However, it may required several lesson sections to form a reliable system for judging inference.

Inference ratings correlated with posttest scores. Table 7 contains correlations between enroute ratings of inference understanding and posttest scores based on information from each of the four sections. As with factual questions, students performed approximately as well on the inference posttest questions as they had on the embedded questions ($r = .71$, $p < .0001$). The trends between ratings and performance varied, however, from embedded questions to the posttest.

Insert Table 7 about here.

Correlations were strongest between ratings and performance on Sections 1 and 4, with a moderate correlation for Section 3 and virtually no correlation for Section 2. The global, seemingly random, relationships between ratings and performance were typified by the correlations obtained between non-aligned section reatings and scores. Significant correlations were found between Section 4 ratings and Section 1 performance (p < .01) and between Section 3 ratings and Section 4 performance (p < .05).

Inference ratings correlated with type of inference question. Table 8 contains correlations between ratings and performance on the two types of inference questions (Interframe and Intraframe). Because there were only four examples of each question type per section, total scores were used. Significant differences for Sections 3 and 4 account for most of the correlation between ratings and scores for both embedded and posttest questions.

Insert Table 8 about here.

Student performance on en-route inter and intra-frame inferences was very similar (61% and 63.75%). It is therefore unlikely that differences in correlations could be attributed to differences in performance. Students appear to judge their inference comprehension more or less singularly, and do not seem affected particularly by either within- or interframe influences.

Fact and Inference Ratings by Section

Table 9 contains intercorrelations between ratings of factual understanding and inferential understanding for each section. Ratings within sections produced the highest correlations of the study (.48, .45, .67, and .78 respectively) and were all significant at the .001 level, despite the fact that performance on fact and inference questions within sections did not correlate highly. This supports the assumption that although students were using some system for judging their level of understanding, the system was not highly related to their actual knowledge of the kinds of information tested. The system also did not differentiate effectively between factual and inferential learning. Rather, both fact and inference ratings appeared related to some global criteria on which students based their assessments.

Insert Table 9 about here.

GENERAL DISCUSSION

The results of this study suggest that learners are not good judges of their en-route comprehension. Little or no correlation between ratings of understanding and subsequent performance for both factual and inferential material were found for either embedded questions or the posttest.

One possible explanation for these results may be related to the subjective nature of "understanding." Students may assess their understanding according to criteria different from one another as well as from the experimenter (Baker, 1979; Garner & Anderson, 1982). Though internally consistent both within and between ratings for fact and inference, the ratings are not related well to any of the scales employed in this study. In addition, the more or less random correlations with the different levels of factual and inferential learning suggest that the student ratings were not based on the types of learning addressed in this study. Ratings appear to be based more on the undifferentiated, global perceptions of students as to their understanding. This presents a potential problem in practice, where the specific intended lesson information may not be the basis for making learner-based instructional control decisions. Based on the findings of the present study, it is simply unclear as to what information is used by students to estimate comprehension.

Some degree of acclimation to the lesson content and procedures was presumed necessary before self-assessments could be considered valid. After several sections and attempts to answer questions, student ratings of understanding should be more accurate, and successive ratings more highly correlated with actual performance. Although this pattern was not demonstrated completely, the data indicated some trends in this direction. Correlations between ratings and performance for both factual and inferential questions were significant mainly in later sections. This trend might have been more pronounced if understanding of factual and inferential questions were more consistent across students. This might be accomplished by clarifying the rating task more through additional initial instruction, including examples of factual and inferential questions, specifying explicitly which questions were factual or inferential, asking students for ratings of specific facts or inferences, or providing response feedback.

Individuals may also evaluate understanding at levels other than those selected in this study. For example, learners may assess understanding correctly at low levels but fail to demonstrate understanding at a higher level. Low level assessment of understanding should be reflected in higher correlations of ratings with factual questions than with inferential questions. It was expected that ratings would correlate more highly with main ideas (gist level) than with lower level facts, indicating that students based their assessment on knowledge of general ideas. The data, however, did not reflect any significant relationships between assessment and level of factual information.

An assessment of understanding based on a high level of assimilation of the material should have caused ratings to be more highly correlated with inferential questions than with factual questions. In effect, one might predict that ratings of inference would be the best predictors of student performance. Again, however, this was not demonstrated. None of the self-assessments were found to be uniformly more accurate than others in forecasting student performance. Unfortunately, ratings were not highly correlated with performance on any of the scales. Instead, there were only correlations between the ratings themselves. Scores on both the embedded questions and the posttest indicated that students remembered high level questions best, but they did not rate their level of understanding based on an accurate assessment of this knowledge.

Finally, since understanding involves the integration of new information with prior knowledge, studies which are relatively short and cover only a small amount of new information may not give learners sufficient time to develop new, or to adapt existing, schema effectively. If an inability to correctly assess understanding is related to the lack of an integrated cognitive schema, assessment and performance should improve in later sections.

Cognitive monitoring can be particularly difficult to study. The process can only be inferred from observed outcomes and from the introspective reports of subjects. Subjects who lack experience with the process of introspection may be unaware of how to attend or what the focus of the attention should be. The resulting reports may reflect processes not anticipated by the experimenter. The findings of this study may be related to such problems.

The popularity of learner controlled computer-based instruction accentuates the importance of further cognitive monitoring research. The tendencies reported for premature withdrawal from CBI lessons may be associated with basic misperceptions of learning. The lack of stronger correlations between self-assessed understanding and actual performance indicates the need for further research in this area.

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Table 1

Ratings of factual understanding correlated with scores on factual questions for each section

		Section Scores				
		Sect 1	Sect 2	Sect 3	Sect 4	Total
Fact Ratings	Sect 1	.25	.22	.20	.17	.38**
	Sect 2	.11	-.05	.43**	.14	.23
	Sect 3	-.02	-.01	.10	.14	.07
	Sect 4	.02	.11	.33*	.30*	.26

Note. Overall fact ratings correlated with fact total at .30, $p < .05$.

$^{*}p < .05$ $^{**}p < .01$

Table 2

Intercorrelations among factual ratings across sections

		Fact Ratings			
		Sect 1	Sect 2	Sect 3	Sect 4
Fact Ratings	Sect 1	X	.55	.35	.44
	Sect 2	(.0001)	X	.46	.47
	Sect 3	(.01)	(.001)	X	.59
	Sect 4	(.001)	(.001)	(.0001)	X

Table 3

Ratings of factual understanding correlated with scores on factual posttest questions by section

		Posttest Scores			
		Sect 1	Sect 2	Sect 3	Sect 4
Fact Ratings	Sect 1	.16	-.03	.16	.33*
	Sect 2	.12	-.16	.20	.21
	Sect 3	.03	-.16	.17	.01
	Sect 4	.04	-.03	.17	.17

* $p < .05$

Table 4

Ratings of factual understanding correlated with scores on factual questions by level

		Levels of Fact Questions					
		Embedded Totals			Posttest		
		1	2	3	1	2	3
Fact Ratings	Sect 1	.28*	.33*	.29*	.12	.10	.29*
	Sect 2	.05	.23	.17	.02	.07	.22
	Sect 3	-.02	-.01	.11	.12	-.10	.11
	Sect 4	.07	.24	.24	.13	.00	.19
	Total	.12	.25	.26	.13	.02	.26

* $p < .05$

Table 5

Ratings of inference understanding correlated with scores on embedded inference questions by section

		Section Scores				
		Sect 1	Sect 2	Sect 3	Sect 4	Total
Inference Ratings	Sect 1	.10	-.14	.25	.17	.17
	Sect 2	.06	.12	.12	-.08	.10
	Sect 3	.23	.09	.37**	.28	.49**
	Sect 4	.27	-.08	.30*	.24	.31*

Note. Overall inference ratings correlated with inference total at .38, $p < .01$.

* $p < .05$ ** $p < .01$

Table 6

Intercorrelations among inference ratings

		Inference Ratings			
		Sect 1	Sect 2	Sect 3	Sect 4
Inference Ratings	Sect 1	X	.29	.10	.35
	Sect 2	(.05)	X	.45	.30
	Sect 3	NSD	(.001)	X	.49
	Sect 4	(.01)	(.05)	(.0001)	X

Table 7

__Ratings of inferential understanding correlated with scores on inferential posttest questions by section__

Inference Ratings	Posttest Scores Sect 1	Sect 2	Sect 3	Sect 4
Sect 1	.30*	.25	-.21	.03
Sect 2	.06	.07	.08	.06
Sect 3	.23	.13	.24	.36*
Sect 4	.41**	.02	.21	.34*

* $p < .05$ ** $p < .01$

Table 8

__Ratings of inference understanding correlated with scores on inference questions by type__

	Types of Inference Questions			
	Embedded Totals		Posttest	
Inference Ratings	Inter	Intra	Inter	Intra
Sect 1	.24	.01	.04	.16
Sect 2	.11	.00	.06	.11
Sect 3	.48**	.37*	.26	.36**
Sect 4	.26*	.22	.18	.44**
Total	.39**	.22	.20	.39**

* $p < .05$ ** $p < .01$

Table 9

Ratings of factual understanding correlated with ratings of inference understanding

		Inference Ratings			
		Sect 1	Sect 2	Sect 3	Sect 4
Fact Ratings	Sect 1	.48**	.07	.30*	.42**
	Sect 2	.21	.45**	.34*	.36**
	Sect 3	.02	.29*	.67**	.41**
	Sect 4	.40**	.29*	.49**	.78**

* $p < .05$ ** $p < .01$

A TIME MANAGEMENT STUDY

by

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Today's information managers are working under considerable pressures--pressures that are unique to this period of time in our institutional and national development. Writers such as Alvin Toffler and John Naisbitt have made us aware of the ongoing change in our world from an industrial nation to an information society. The roles of all institutions are in the process of change. New technologies are available to assist in providing better control over information, and their use is rapidly being adapted to a wide range of services and operations--but the cost is high. These high costs of managing information have come about at a time when institutional budgets are considerably leaner than they were. If the challenges of this new information society are to be met head-on, personnel costs must be reduced. This means that along with the new technological time saving devices, both staff and management will need to become more productive. One road to increased productivity is that of efficient time management.

A study on time management practices was undertaken among one group of information managers--the directors of large academic libraries--with the support of a Librarian/Scholar grant from the Council on Library Resources. Although the study can only be generalized to other groups based on the degree to which they fit the description of the population surveyed, the results will be of interest to all types of information professionals, including those in media services and telecommunications who work in institutions of higher education.

Although there is a considerable body of writing and research on the subject of time management in the business literature, little existed in the library literature that dealt specifically with management. A survey approach was deemed the most useful method to generate data that would provide insights useful in evaluating time management practices among managers of large academic libraries. The results of this study provided a basis for evaluating the training of library managers, determining the need for additional research in the field, and an opportunity for academic library directors to compare their own responses to those of others in similar positions.

Objectives of the Study

Four objectives of the study were designed to determine:

1. To what degree library managers are aware of and practice efficient time management methods, including delegation of authority and leadership style.
2. Time management practices as related to:
    a. leadership style

    b. sex of manager
    c. number of people managed
    d. years of experience as a library director

3. Identification of the most serious time wasters.
4. How library directors reportedly spent their time based on twelve specified categories.

Sampling

The population that was surveyed consisted of 189 directors from large academic libraries. Two mailings of the survey were sent out to ensure at least a 60 percent return. The final number of questionnaires returned was 159. Since the entire population of directors of large academic libraries were polled, and 82% of them responded, we may for all practical purposes consider that we are dealing with a population as opposed to a sample in this study.

Data Collection, Analysis and Results

Items used to collect the data in the mailed survey were based on the time management literature. They fell into five categories: 1) a profile of the respondents, 2) how a manager's time is reportedly spent, 3) delegation of authority, 4) time wasters and 5) leadership style. The survey was pretested using N = 12.

The SPSS statistical package was used to analyze the data collected from the survey. Three types of analyses were calculated, including frequency, Pearson product-moment correlation and chi-square with cross tabulation.

In the areas of the academic library director profile and how respondents' time was spent (Tables 1 & 2), the results of frequency analysis indicated that the population was mature both in age and experience, although almost half of them (46.5%) had been in their current position five years or less. Most of them administered staffs under 300, and only 21% of them were female. They spent a large percent of their time involved in meetings and with committees and lesser amounts of time in planning, reporting, supervising, budgeting and personnel work. Few of them spent more than three hours a week on external fund raising, but 55% of the directors spent 21 days a year or more off campus attending professional meetings or other work related events.

TABLE 1

University Library Director Profile

Size of library staff	1-150	151-300	301-450	451+
Percent:	57.9	31.4	7.5	3.1
Number of years in current position	1-5	6-10	11-15	16+
Percent:	46.5	25.2	15.7	22.6
Number of years as a library director				
Percent:	38	17.7	16.5	27.8
Number of years as a a library administrator				
Percent:	6.3	12.6	16.4	64.8
Age	23-35	36-45	46-55	56+
Percent:	.6	22.6	47.8	28.9
Gender	MALE		FEMALE	
	78.6		21.4	

TABLE 2

PERCENT OF TIME SPENT ON MANAGEMENT ACTIVITIES

Hours per week:	0-3	4-7	8-11	12-15	16-19	20+
Planning	18.2	46.1	22.1	11.7	1.3	.6
Reporting (internal & external communications)	18.5	48.4	22.9	7.6	2.5	0
Supervising	56.8	30.4	10.1	1.4	.7	.7
Budgeting	44.8	43.5	9.1	2.6	0	0
Personnel work (including collective bargaining, labor relations)	42.2	38.3	14.3	3.9	1.3	0
Meetings with university administrators	49	13.9	5.1	1.9	0	0
Meetings with library administrators (e.g., assistant/associate directors, department heads)	3.9	55.5	30.3	8.4	.6	1.3
Library committees	63	30.5	3.9	2.6	0	0
University committees	67.5	27.4	3.8	.6	.6	0
External fund raising	69.1	24.2	4.7	1.3	.7	0
Number of days per year off campus for professional meetings or work related events	0-10	1-20	21-30	30+		
Percent	4.5	41.3	33.5	20.6		

Delegation of authority is considered an all important skill in the management of time. Information about how knowledgeable the respondents were about the delegation of authority was collected using a four-point "agree-disagree" Likert-type scale in response to a series of statements on the subject (Table 3).

Eighty-five to 90% of the academic library directors demonstrated good to excellent knowledge in this area. The two statements in which fewer of them responded appropriately for an effective delegator had to do with permitting staff to make mistakes and in doing tasks that their subordinates should be doing.

TABLE 3

DELEGATION OF AUTHORITY*

	Agree Strongly AS	Agree A	Disagree D	Disagree Strongly DS
1. I frequently allow my staff to make mistakes.	13.8	49.7	29.6	6.9
2. My staff make most of the day-to-day decisions about their work without my prior approval.	60.1	38	1.3	.6
3. I frequently do tasks that my subordinates should be doing.	1.3	29.7	43.7	25.3
4. The library does NOT function smoothly when I am absent.	.6	2.5	37.1	59.7
5. I seldom revise decisions made by my staff.	28.9	59.7	10.7	.6
6. I give my library staff considerable authority over work (e.g., personnel, finances, facilities and resources).	44	50.9	5	0
7. I frequently make decisions that are part of my subordinates' jobs.	0	9.5	55.1	35.4

TABLE 3 (CONT'D.)

	Agree Strongly AS	Agree A	Disagree D	Disagree Strongly DS
8. I delegate most library operations to my staff.	42.1	51.6	5.7	.6
9. If I were incapacitated for six months, there is someone on my staff who could readily take over my job for that period of time.	44.9	41.8	10.1	3.2
10. The department heads under my leadership do NOT delegate work well to their own subordinates.	1.3	9.2	64.7	24.8
11. My key people take the initiative for projects without waiting for me to think of them.	26.1	59.2	1.0	.6

* Percent of academic library directors responding

The library directors who answered the time management survey were asked to rank their top ten time wasters out of a list of 15. This list was then compared to responses to the same list which had been submitted to sales representatives and engineering managers in fourteen countries by Michael LeBoeuf and reported in the February 1980 issue of Business Horizons (Table 4).

TABLE 4

TOP TEN TIME WASTERS RANKED BY THREE OCCUPATIONAL GROUPS

	Library Manager	Sales Reps	Engineering Managers
Attempting too much at once and estimating time unrealistically	1	8	---
Cluttered desk and personal disorganization	2	---	---
Confused responsibility and authority	---	---	---
Crises (personal and/or staff)	5	4	6
Drop-in visitors	6	2	9
Inability to say no	---	---	---
Inadequate, inaccurate, or delayed information	7	---	1
Indecision and procrastination	---	7	8
Ineffective delegation and involvement in routine and detail	9	---	2
Lack of objectives, priorities and deadlines	---	6	---
Lack of, or unclear, communications or instructions	4	10	5
Lack of self discipline	10	3	10
Leaving tasks unfinished	---	9	7
Meetings (scheduled and unscheduled)	3	5	4
Telephone interruptions	8	1	3

Engineering managers did not rank attempting too much among their top ten time wasters, and sales representatives placed it near the bottom of their list. Neither sales nor engineering personnel listed a cluttered desk and personal disorganization among their top ten time wasters. There were other differences between the two management groups. For example, library managers indicated better control over the telephone than engineering managers. Library managers also perceived themselves as having fewer problems with delegation of work and having better access to information. However, there were more similarities than differences, which are born out by a low positive relationship between the two groups of managers with a correlation of .3045. On the other hand, a very low negative correlation at -.1755 was found between library managers and sales representatives.

Much has been written about leadership style over the years. In the beginning there was an effort to identify the traits of a leader. Later, researchers in the field of industrial psychology and management believed that leaders were either process--that is, people oriented--or they were task oriented. Today there is a trend toward team leadership which incorporates both aspects of leadership--a concern with high productivity and a concern for people. Based on the Blake and Mouton Managerial Grid model, five possible leadership styles were identified depending on how respondents ranked an equal number of statements about how they dealt with conflict (Table 5). These leadership styles are based on a task-process grid that identifies the degree to which the respondent is: primarily concerned with getting the work of the organization carried out (9,1), primarily concerned with the welfare and the people in the organization (1,9), concerned with neither task nor people (1,1), equally concerned with task and process (9,9), or at some midpoint, balancing between either task or people (5,5). A majority of the academic library directors ranked the team management conflict statement as the one that matched their most typical response. Team management integrates both task and people concerns in a leadership style that works toward developing trust and committment in employees in an effort to foster greater productivity.

TABLE 5

LEADERSHIP STYLE

Rank	Conflict Statement
5	When conflict arises, I try to identify reasons for it and seek to resolve underlying causes. (9,9)
4	When conflict arises, I try to find a compromise that everyone will be satisfied with. (5,5)
3	When conflict arises, I try to remain neutral. (1,1)
2	I avoid causing conflict, but when it does appear, I try to smooth things over so everyone will be happy. (1,9)
1	When conflict arises, I try to cut it off or win my position. (9,1)

Correlations were run for all variables in the study. Although some writers in the field of research methodology are critical of this approach and regard it as a "fishing expedition", there are advantages in this type of a study. The results of the Pearson product-moment correlation were for the most part predictable. Correlations were found among the number of years the respondent had been in a management position, experience as a library director, administrator, including department head or assistant/associate director and age (Table 6).

TABLE 6

RESPONDENT CHARACTERISTICS

	A	B	C	D
A. Number of years in current position		.7729	.623	.5294
B. Number of years as a library director	.7729		.5560	.4847
C. Number of years as a library administrator incl. dept. head, etc.	.4626	.5560		.4768
D. Age	.5294	.4847	.4768	

Correlations among the hours spent on meetings with university committees and the time spent in meetings with university administrators and with library committees suggested that the meeting style of university administrators may provide a role model or organizational style for the subsequent frequency of committee meetings within the library (Table 7).

TABLE 7

HOURS SPENT ON MANAGEMENT ACTIVITIES

	Hrs. Spent on Meetings with University Committees
A. Hrs. spent in meetings with university administrators	.3751
B. Hrs. spent with library committees	.4864

Correlations among the delegation statements were also predictable with those respondents who were reluctant to give staff authority over operating decisions perceiving that their library would not run smoothly when they were absent. Those library directors who did not feel that if they were incapacitated for six months, there was someone on their staffs who could take over, were more inclined to make decisions that were part of their subordinates' jobs (Table 8).

TABLE 8

DELEGATION OF AUTHORITY

	A	B	C
My staff make most of the day-to-day decisions about their work without	-.3807		
I frequently do tasks that my subordinates should do.		.5013	
I seldom revise decisions made by my staff.			.3667
I give my library staff considerable authority over their work.			.3716
If I were incapacitated for six months there is someone on my staff who could take over.		-.3550	

A: The library does NOT function smoothly when I'm gone.
B: I frequently make decisions that are part of my subordinates' jobs.
C: I delegate most operations to my staff.

Chi-square with cross tabulations were calculated for some of the data. In this study we were interested in the existence of significant associations among the respondent characteristics and the variables reflected by the data collected in Sections II and III of the survey instrument. These two sections dealt with how time was allocated for the various management activities and delegation. Significant associations were found among four sets of variables. The first was a very significant association at the p = .02 level of confidence between the number of years as a library administrator, including that of department head and assistant/associate director and the statement, "The department heads under my leadership do NOT delegate work well to their own subordinates". Those who responded in the "disagree" columns were more frequently academic library directors with fewer years of administrative experience. The appropriate response to this statement for an effective delegator was in either one of the "agree" columns.

The age of the academic library director was a significant factor in two cases. The age of the respondent was a highly significant factor in the number of days spent off campus at the p = .0001 level of confidence. The older the director, the more days he or she spent off campus attending professional meetings or work related professional meetings or work related events.

Age was also a factor in response to the statement, "I frequently do tasks that my subordinates should be doing". A significant association was found between the age of the academic library directors who responded in the "agree" column at the p = .01 level of confidence. The most frequent respondents were those who were 56 years of age or older. The appropriate response to this statement for an effective delegator is in either one of the "disagree" columns.

Gender was a factor in the number of hours spent on library committees. At the p = .001 level of confidence, females were found to have a highly significant association in the amount of time spent on library committee work, with women spending more hours on this activity than men.

Conclusions and Recommendations

The implications for this study are that the academic library directors who responded to this questionnaire are experienced and mature individuals who are knowledgeable about appropriate delegation skills and for the most part, team management oriented in their leadership styles. Their selection of the top three time wasters helped to focus on those areas in need of attention. The first concern is the need to examine the amount of time spent on committee work. As organizational structure continues to evolve, new ways of dealing with decision making and work flow, other than the committee, must be developed for greater productivity, without the director falling back on an outmoded authoritarian style. Second, the problem of taking on too much work at the same time should be addressed. This problem could be a matter of more effective delegation; however, given the results of the study, it is very likely that it has more to do with identifying goals and establishing priorities. Utilizing time management techniques can also resolve the problem of the cluttered desk. Both of these latter two time wasters are probably the outgrowth of a bureaucratic organization, such as the university, where committees proliferate.

Additional research into these assumptions should be carried out, including the effects of training decision making groups in group dynamics. A replication of this study with other groups may also prove useful.

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Relationships Among Text Format Variables in Computer-Generated Text

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Abstract

Relationships among Text Format Variables in Computer-Generated Text

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Several text format variables were examined in an experiment to identify the ways in which these variables, under specific design combinations, interacted. Text format variables are those elements used to create legible instructional text. The variables examined in this study include heading location (embedded or isolated), line length (long or short), space between lines (single or double), paragraph indication (indented or spaced), use of running heads (present or absent), and directive cues (present or absent).

Sixty-four computer text types were designed using all possible combinations of the six bivariate text format variables. The text types were presented to the subjects, who sorted them into seven normally distributed categories (Q-sort procedure) based upon their perceived **study-ability**. Study-ability was operationally defined as the rating assigned by participants to models of computer-generated text based on the perceived ease with which a text model could be read and studied as if the model were actual text. Data from the Q-sort were analyzed via a 6-way repeated measures analysis of variance. Two significant ($p < .01$) 5-way interactions were interpreted.

Results suggested several text design considerations. The presence of a running head was a preferred design consideration and its interaction with the other variables usually served to improve the study-ability rating of the text type. The presence of directive cues is also a preferred design condition, tending to improve the rating. While double spaced text was preferred, a single spaced text with running head and/or directive cues would be preferred more than a double spaced version without running head or directive cues. The location of headings had the greatest affect on the ratings, probably because it had the most noticeable effect on the image of the text, though its affect on ratings was unpredictable. The more organized and structured appearance of the spaced paragraph condition probably combined with the running head and directive cue conditions to produce a more study-able appearing screen. Line length did not appear to be a significant factor in the study-ability ratings, though all things being equal, short lines were preferred.

Relationships Among Text Format Variables in Computer-Generated Text

Problem Summary

Text format variables are components used to create legible instructional text. Some examples of text elements used within the realm of a cathode ray tube display (CRT) include headings, illustrations, line length, leading between lines, kern between letters, paragraph indication, the use of running heads, heading location, directive cues, type style, type size, empty space, and graphic devices.

Initially, legible text was thought to be a function of the size and style of type, therefore research concentrated on the effects of individual symbols upon visibility and recognizability. A symbol considered visible was considered legible. But, as more was learned about the processes of cognition and reading, the overall comprehensibility of instructional text was considered an important element of legibility. Legible pages or screens should designed to look like a collection of ideas, organized and understandable, rather than like a collection of letters; they must flow, and be interpretable as well visible and recognizable (Ryder, 1979). However, there exist no formal guidelines for the design of screen layouts. This experiment investigated the manner in which several text elements interacted when specific arrangements were judged by perceivers.

Research into combinations of text elements presents unique methodological problems for, there is almost an infinite variety of text element combinations. For example, a researcher may compare three type sizes, two line lengths, three types of directive cues, two heading locations, two paragraph indications, three graphic organizers, and two conditions of running heads creating a 3 X 2 X 3 X 2 X 2 X 3 X 2 design with 432 different stimulus combinations--not to mention the implications of performing a 7-way analysis of variance.

In an effort to reduce the number of variables to a manageable, yet realistic number, the chosen text elements were leading, directive cues, paragraph indication, running heads, heading location, and line length.

----------Insert Table 1 here.----------

Leading

Leading was defined as the quantity of empty space between lines of text. For "paper" publications, Tinker (1965) suggested that under optimal conditions, in terms of both line length and type size, the leading between lines be approximately 1.0 and 1.25 point between the bottom of the descender from the upper line and the top of the ascender from the lower line. Hartley (1978) stated that the leading should be equal to the spacing between words, an amount similar to Tinker's suggestion. The key here is "optimal conditions," for when lines are extremely long more leading is required (Tinker, 1963).

In CRT display research, Kolers, Duchincky, and Ferguson (1981) found that double spacing between lines of text on a CRT marginally increased reading speed over single spacing. However, they also found that reading single spaced text required less occular effort, because more densely packed text requires smaller and fewer eye muscle movements. Grabinger (1984, 1985) found that perceivers preferred double spaced text; but, this preference was not clear cut and appeared to interact with other text element variables. The two values investigated were single spacing (S1) and double spacing (S2).

Line Length

With regard to line length as a format variable, Turnbull and Baird (1964) recommended that lines of text be between 26 to 65 characters long for a given style and size for paper displays. Keenan's (1981) research with CRT displays supports this. Keenan used a computer to determine the optimal line length in terms of meaningful phrase units for different readability levels and found that line lengths in the vicinity of 45 to 55 characters maintain the integrity of the greatest number of idea units. Yet, despite this research designers often persist in long lines of text. The two conditions investigated were 60 (LL) and 40 (SL) character lines. Both conditions fall within CRT and paper standards, yet are different enough to create distinct differences among the images.

Directive Cues

The use of directive cues is one of the few format elements that has had a positive effect on some types learning in both paper and CRT investigations. Cues such as underlining, upper case letters, or multicolored text have improved recognition and recall tasks when used sparingly and related to desired outcomes (Christ, 1975, 1977; Hartley, Bartlett, and Branthwaite, 1980; Tullis, 1981). Perceiver reactions to directive cues are harder to describe. When examined alone, directive cues appeared to have little affect on preferences expressed by participants; yet, in combination with other text elements the cues contributed to the appearance of well organized and structured designs (Grabinger, 1984, 1985). Since a wide variety of cues have been found to be effective, the main questions are related to whether cues are present or not and how they relate to other format variables. The two conditions investigated were Cues Present (CP) or Cues Not present (CN).

Paragraph Indication

The shape of the text on the page or screen can be changed quite noticeably through paragraph spacing and indentation. Efforts to use complicated indenting patterns to represent the structure of the text on paper displays have not improved retention or recall under most circumstances (Frase and Schwartz, 1979; Hartley, 1980; Shebilske and Rotondo, 1981). However, it has also been found that readers' design preferences are affected by spatial changes such as paragraph indication (Siskind, 1979), partly because the text may look more organized and structured (Grabinger, 1984). The use of spatial cues is a highly visible format factor so two conditions were investigated: increased use of white space (PS) (double or triple spacing between paragraphs) and traditional indentation (PI).

Running Heads

Heines (1984) recommended the use of a format variable called hypertext, or running head, to help keep readers apprised of their location in a lesson, the lesson content, their progress, and essential computer commands. A running head is recommended because CRT text pages are short, change frequently, and the nature of a CAI lesson often prevents easily flipping ahead or backward. The running heads are usually placed along the top or bottom of the screen, though may also be found along the sides. Operationally, this variable took two forms: present (RH) or absent (RHN).

Heading Location

Heading location was the final variable included in the investigation. While, the use of headings, particularly in question form, has facilitated learning (Hartley and Trueman, 1982; Holley, 1981) the location of the headings affect the appearance of organization and structure of the page. Since, the presence of headings has facilitated learning it was decided to test two conditions that affect the appearance of the screen: headings were either embedded in the text (HE) or isolated in a separate column (HI).

Research Questions

Several hypotheses could be listed that would predict the effect of one variable and one condition on another. However, the purpose of this study was to explore the way or ways in which these variables interact together. The purpose is analogous to examining the Gestalt of the screen, to inspecting the affect of the whole as a sum of its parts. The purpose of instructional text is to provide material that will promote learning; therefore, instructional text is intended to facilitate an interactive cycle between the learner and the stimulus. The basic problem is the identification of combinations of text element variables that can be constructed or shaped or molded by text designers or CAI writers in ways that facilitate the learning process. Or, how do specific combinations of variables effect each other?

The first step in answering that question was to determine the initial preference reaction of a potential reader to specific text designs. Why examine preferences, especially since preferences are often unrelated to such tasks as recall or retention? First, Tinker and Paterson (1942) found that legibility was positively related to a reader's judged pleasingness of the text. Tinker (1965) also found that readers seldom preferred a text design of less than optimal legibility and tended to equate pleasingness with legibility. Bryant et al. (1981) discovered that preferences affected purchasing behavior when students were more likely to purchase textbooks with illustrations than same textbook without illustrations.

A second reason for using preferences as a starting base is the nature of the perceptual cycle. If it is accepted that legibility is more than the recognizability of a symbol, then the whole cognitive cycle (Neisser, 1976) provides ground for research. The combinations of the text elements becomes more important that the individual symbols, because the potential affect of the initial perception of the document upon a reader's schema. The reader may have particular study or reading strategies that are activated by specific combinations of format variables

In conclusion, it was proposed that an examination of a "whole" would shed more light on the "parts" than an examination of each part separately. The variables chosen for study cover a range of design decisions from the placement of white space to cues that emphasize particular words. Highly organized and controlled designs were compared in an effort to identify ways text format variables interacted.

Methodology

Sample

This was an opportunity sample composed of 31 undergraduate student volunteers, all single, between the ages of 20 and 25, United States citizens, and predominately female.

Materials

Sixty-four computer text types (see Appendix A for samples) were designed through the use of different combinations of six bivariate format variables. To avoid confounding the treatment with contextual factors the text types were designed using the notation method (Twyman, 1981). In place of actual text, "X"s were used to represent the bulk of the print on a page; "O"s to reflect the occurrences of italics, upper case, bold type, color, headings, or reverse type; and "I"s as a tertiary graphic unit to represent something particularly unique in style. As a result of participant comments in the Grabinger, 1984 study the standard use of the notation method was altered slightly by incorporating spaces to make groups of "X"s look more like words in actual text. Although it can be suggested that the use of the notation system reduces ecological validity, it is argued here that its use emphasizes the image of the page as whole visual entity. Each page was designed on an IBM PC computer with the **Multimate** word processor program. The stimuli pages were printed on a dot-matrix printer, enlarged on a photocopy machine, and laminated for durability.

Eliciting Preferences

The text types were presented to the subjects together with discriminating and sorting instructions to elicit perceptions about their **study-ability**. Study-ability was operationally defined as the rating assigned by participants to models of computer-generated text based on the perceived ease with which a text model could be read and studied as if the model were actual text.

Utilizing recorded instructions (see Appendix B), subjects were asked to perform an unstructured Q-sort of the 64 text types or stimuli. The Q-methodology was used because of its usefulness in exploratory research, in turning up new ideas and hypotheses (Kerlinger, 1973). Subjects sorted the stimuli into seven piles in quantities that reflected a normal distribution. In this sorting procedure, the four texts perceived to be the highest in study-ability were placed in pile 1, while those four perceived to be the lowest were placed in pile 7. From the remainder of the text types, those eight believed to be the highest in study-ability were placed in pile 2 and those eight considered to be of the lowest in pile 6. The forty stimuli left over were allocated among the remaining inner three piles with the 12 believed to be the highest in study-ability placed in pile 3 and the 12 lowest in pile 5. The remaining 16 were placed in the middle or fourth pile. After completion of the sorting task the participant was interviewed about the criteria used during the task. Responses were written down by the experimenter. Participants were shown the first pile and asked, "Why did you rate these the highest on the study-ability factor?" Then, they were shown their seventh pile and asked, "Why did you rate these the lowest?"

Results

The matrix presented in Table 2 depicts the raw data arrangements of 64 CRT text types generated by the sortings of the subjects in the sample. A single value in each column is a rating of the relative study-ability of the respective text as perceived by the particular subject, represented in the row of the matrix. This data was analyzed via a repeated measures analysis of variance (BMDP, 1981). A conservative .01 level of significance (suggested by Kerlinger, 1973) was accepted to offset the the dependence that may result among stimuli during the Q-sort. The main ANOVA results are presented in Table 3.

----------Insert Table 2 here.----------

----------Insert Table 3 here.----------

The primary ANOVA produced two significant interactions among the text element variables for further analysis. These were the "running head by heading location by cues by spacing between lines by line length" interaction (RHCSL) and the "running head by cues by spacing by line length by paragraph indication" (RCSLP) interaction.

One way of analyzing a multiple interaction is by isolating the interactions at each level or order (Keppel, 1982). In this way we can look at each variable under constant conditions. This, in turn, produces a set of marginal means that may be used to graph the information in a way that allows one to spatially inspect the results. This is accomplished via further ANOVAs. For example, the first step in the RHCSL analysis was to determine which condition of the Line Length variable was interacting with the other variables. ANOVAs were run holding the conditions of RHCS variables constant under both Line Length conditions finding that the short line length (LS) value contributed to the interaction (see Figure 1). Next, Double and Single Spacing were compared while holding RHCL constant. This process was continued for all five variables in the interaction. The ANOVA tables are not printed because there are several hundred. The results of this "slicing-off" process for both five-way interactions are presented in Figure 1.

----------Insert Figure 1 here.----------

----------Insert Table 4 here.----------

RHCSL Interaction

The variable conditions running head present (RH), directive cues present (CP), single spacing (SI), short lines (LS), and embedded headings (HE) contributed to the interaction. This in itself tells little, but by taking the marginal means of the study-ability ratings (see Table 4) the interaction can be "mapped out" in a series of graphs to aid interpretation (see Figure 2). By comparing the graphs of the RHCSL interaction the following statements can be made:

----------Insert Figure 2 here.----------

1. The presence of a running head in a design was always preferred over the same design with no running head (Figures 2a to 2h).

2. The presence of directive cues were preferred over no directive cues (compare 2a and 2b, 2c and 2d, 2e and 2f, and 2g and 2h).

3. Short lines were preferred over long lines (compare 2a and 2e, 2b and 2f, 2c and 2g, and 2d and 2h).

4. Double spacing was usually preferred over single spacing (compare 2a and 2c, 2b and 2d, 2e and 2g, and 2f and 2h).

5. Generally, it seems that isolated headings and directive cues work together to produce favorable designs. It seems that directive cues played an important role with the heading location. Designs using both directive cues (CP) and isolated headings (HI) were favored over those with embedded headings (HE) and directive cues (Figures 2a, 2c, and 2e). However, when directive cues were not present (CN) the embedded heading designs were preferred over the isolated heading designs (Figures 2b, 2d, 2f, and 2h).

6. The interaction of heading location with the running head condition is difficult to predict. The most visible change in a design combination is found in Figure 2e. The blending of isolated heading, running head, cues, single spacing and long lines was significantly preferred over designs with embedded headings, with and without running head. However, in Figure 2d the isolated heading condition combines with the no running head (RHN) condition to improve the appearance of the design.

7. Though, comparison of Figures 2e and 2g show that isolated headings were favored in a single spaced layout while in the same layout with double spacing embedded headings were preferred.

8. The most preferred design combination was composed of running heads, isolated headings, cues, double spacing and long lines (see Figure 2c).

9. The least preferred design combination was composed of no running heads, isolated headings, no cues, single spacing, and short lines (see Figure 2f).

RCSLP Interaction

The significant variables found in the RCSLP interaction were running heads present, directive cues present and absent, single spacing, long lines, and indented paragraphs (see Figure 1). The following statements can be made about the variables, based on Figure 3:

----------Insert Figure 3 here.----------

1. Designs with a running head (RH) were always preferred over designs with no running heads (RHN) (Figures 3a to 3h).

2. Double spacing (S2) was preferred over single spacing (S1) (compare 3a and 3b, 3c and 3d, 3e and 3f, and 3g and 3h). Note especially graphs 3c and 3d where the spacing between lines has a dramatic effect under the running head (RH), short line (LS) indented paragraph condition (PI).

3. Spaced paragraphs (PS) were preferred over indented paragraphs (PI) (compare 3a and 3e, 3b and 3f, 3c and 3g, and 3d and 3h).

4. There seemed to be a general preference for long lines (LL) over short lines (LS) (compare 3a and 3c, 3b and 3d, 3e and 3g, and 3f and 3h).

5. The presence of directive cues (CP) was preferred over the no cue condition (CN) (compare graphs 3a through 3h). Figures 3a, 3c, 3e, 3g, and 3h show the significant effect of cues over no cues. The cues seemed especially sensitive to the running head condition (CP-RHN). When the both cues and running heads were absent from designs the disapproval went up further than when the running head was present without cues (CN-RH) (Figures 3a, 3c, 3d, and 3h).

6. In Figures 3d and 3e the absence of a running head had far greater impact on the design than did the absence of cues under double spacing, short lines, and indented paragraph combination.

7. The most preferred design combination included running heads, cues, double spacing, long lines, and spaced paragraphs (see Figure 3f).

8. The least preferred design combination included no running heads, no cues, single spacing, short lines and indented paragraphs (see Figure 3c).

Discussion

In terms of study-ability preferences for images of text, the implications for design are many. However, since the effect of these designs on achievement has not yet been established no generalization in that direction should be made.

The use of a running head is one of the most stable results of the study. No design combination without a running head was preferred over designs with a running head. Although it interacted with other variables in affecting preference its interaction was always in a positive direction.

The presence of cues as a preferred element in text design was also a fairly stable influence. The use of cues seemed to improve the study-ability rating in all situations except one (Figure 3d, running head (RH) line). It could be that that particular combination produced the simplest and most spacious design, looking very easy to read and study.

Another fairly consistent trend was found in the preference for double spaced text over single spaced text. However, upon examination of the interactions it was found that spacing was easily influenced by other factors. For example, the absence of a running head had greater impact on the study-ability rating than did spacing when comparing Figures 3g and 3h (compare the RHN dot in each graph). While subjects probably preferred the more spacious look of double spaced text, the spacing of the text did not seem as important in making a study-ability judgment as cues or running heads. This suggests that design features that affect the organization and hierarchical structure of the text are more important than the appearance of spaciousness.

Long lines were preferred over short lines, though this did not seem to be a strong preference. Figure 2 shows this to a greater extent than Figure 3. This is probably due to the heading location conditions in Figure 2 which may have emphasized the difference between the two line length conditions.

The usual interaction between line length and line spacing did not seem to occur. This may be explained by the narrow difference between the two line length conditions since, both the 40 character line and 60 character line fell within legibility recommendations.

The affect of the heading conditions was widely variable. This may be due to the radical effect heading position has on the text design, since it changes the margins, body of the text, and overall image more than any other change.

The affect of paragraph indication is consistent, though not great. Generally the spaced paragraph condition was preferred over indented paragraphs. Its interaction with other variables was positive but slight. The only unusual incident is seen in Figures 3a and 3e. Here the paragraph condition appears to interact with cues and running heads. In Figure 3a there is a wide difference between cues present and the two running head conditions. Figure 3e shows a wide disparity between the two running head conditions in the no cues condition. The more organized and structured appearance of the spaced paragraph condition probably combines with the running head and directive cues to produce a more study-able appearing screen.

Conclusion

Generally, although the variables discussed combine to interact when influencing preference for studying they are for the most part predictable. A designer that followed a practice of utilizing running heads as general organizers, spaced paragraphs, and a few directive cues for emphasis would probably create pages or screens that produce a more positive opinion about study-ability within potential readers. Though the most preferred design in the RHCSL interaction had isolated headings, the position of headings is probably not as critical. The effect of no headings on a study-ability rating would probably be greater. While it appears that readers prefer double spacing and long lines, these factors did not appear to contribute as much to the study-ability of the document as the other variables.

While preference is related to legibility, the ultimate test is learning. Remaining questions include the effect of these designs on learning and the activation of learning strategies.

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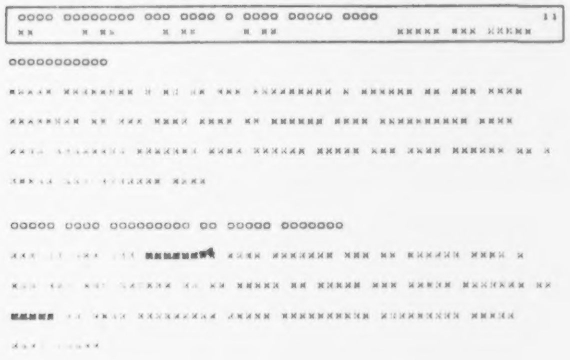
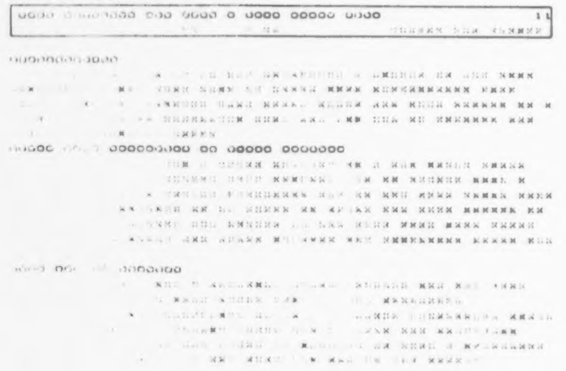
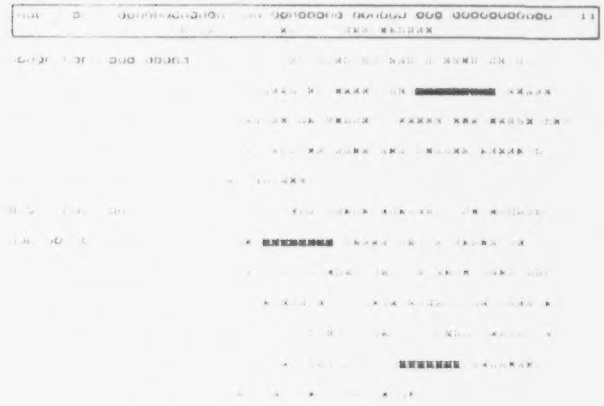
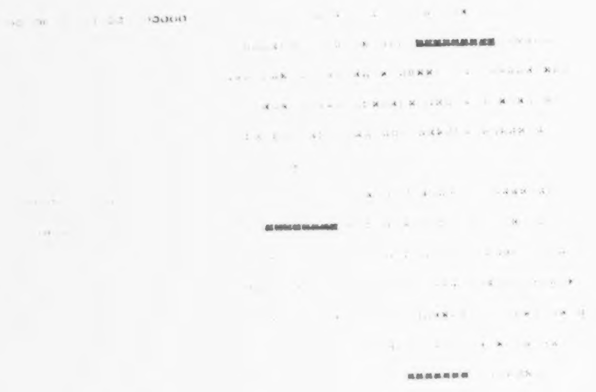
Appendix A: Stimuli Samples









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Appendix B

Instructions to the Subjects

You will examine several models of computer-generated text. These are models of text that may be seen on computer television screens when using computer-assisted instruction.

Before you begin, look at some of the text models in front of you. Note that they are composed of "X"s and "O"s. The "X"s represent the body of the text. The "O"s represent words that are special, such as headings or subheadings. On some of the models you will see three sets of "X"s that are darker than the rest of the text. These dark sets of "X"s represent words that may be in italics, bold type, or underlined. Finally, some of the models have a box at the top of the page. This box is called hypertext and contains a summary of the content of the lesson and a list of computer commands that may help the learner during the lesson.

When you examine the text models evaluate each model on a factor called "study-ability." "Study-ability" refers to both readability and learning characteristics. For example, a text model with a high "study-ability" factor would appear easy to read and easy to study. On the other hand, a text model with a low "study-ability" factor would appear hard to read and hard to study. You are the judge of what appears easy or hard to read and study. There is no right or wrong answer. The best answer is whatever you decide. Look at each model and ask yourself, "If this were actual text would I find this style easy to read and study or hard to read and study?"

Sort the 64 models of computer-generated text into seven piles according to the "study-ability" factor. Remember to base your judgements on how easy the model appears to study as if the model were actual text. Use the sorting procedure described as follows:

In Pile No. 1, place the 4 text models that have the highest "study-ability" factor. In Pile No. 7, place the 4 text models that have the lowest "study-ability" factor. One way to do this is to go through the text models sorting them into high, medium, and low "study-ability" piles. Then return to the "high" pile and find the four with the highest "study-ability" rating and place them in Pile No. 1. Then, go to the "low" pile and find the four with the lowest "study-ability" rating and place them in Pile No. 7.

After placing models in pile numbers 1 and 7 there will be 56 models left. Place all of the models together and repeat the sorting procedure. Place the 8 with the highest "study-ability" rating in Pile No. 2 and the 8 with the lowest "study-ability" rating in Pile No. 6.

Then there will be 40 text models remaining. Place all of the models together again and re-sort them. From these 40 models place the 12 with highest "study-ability" rating in Pile No. 3 and the 12 with lowest rating in Pile No. 5.

There will then be 16 models left and they are all placed in Pile No. 4.

The number of the text models to be placed in each pile also appears on the pile identification cards on the table in front of you. you may rearrange the models until you are satisfied with their placement, but make sure you place the specified number of text models in each pile.

you may refer to these instructions or ask the experimenter for help whenever you wish. Finally, remember to judge each model on how easy it appears to study as if it were actual text.

Table 1

Variables Used in Stimuli Design

Leading:	(S1)	single spacing
	(S2)	double spacing
Directive Cues:	(CN)	no directive cues present
	(CP)	directive cues present
Paragraph Indication:	(PI)	indented paragraph
	(PS)	spaced paragraph
Running Head:	(RHN)	no hypertext present
	(RH)	hypertext present
Heading Position:	(HE)	embedded headings
	(HI)	isolated headings
Line Length:	(LL)	long (60 character) line
	(SL)	short (40 character) line

Table 2

Raw Data Matrix

Subjects

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Text 1	3	3	5	2	3	7	5	5	4	5	2	3	3	1	5	3	1	2	4	4	3	2	1	3	2	4	6	4	2	2	4
Text 2	3	2	1	1	2	5	4	1	3	3	2	3	4	2	3	1	2	2	4	2	4	1	3	3	2	6	5	2	1	3	1
Text 3	3	5	6	2	4	7	5	5	4	6	5	3	2	1	6	6	5	4	4	3	5	2	4	3	2	7	6	6	5	2	3
Text 4	3	2	7	1	6	6	6	3	1	4	5	3	5	4	7	7	3	3	5	2	6	2	4	2	2	7	6	3	1	3	6
Text 5	2	1	4	3	4	4	2	6	3	5	1	2	3	1	6	3	1	2	2	7	1	3	1	2	3	3	5	4	4	1	6
Text 6	2	3	3	3	3	5	3	5	1	4	1	2	3	2	5	2	1	2	3	3	2	3	1	2	2	4	5	4	3	2	4
Text 7	2	5	4	2	3	5	1	5	3	5	4	1	6	1	7	3	2	3	2	3	2	3	4	2	3	4	2	3	1	1	5
Text 8	2	2	2	3	2	4	3	5	2	4	2	2	6	2	5	4	4	3	2	3	3	3	2	2	2	4	3	4	1	3	4
Text 9	4	6	4	1	4	6	5	5	4	4	3	6	4	4	4	3	2	3	6	4	4	4	3	5	4	5	3	4	5	4	2
Text 10	4	3	3	1	2	5	2	1	3	2	2	5	3	4	2	1	2	3	5	4	5	3	4	5	3	5	2	3	3	4	1
Text 11	4	6	6	5	4	7	5	3	5	5	6	6	5	4	4	6	5	4	7	3	3	3	3	5	4	6	4	6	4	4	3
Text 12	4	3	2	3	2	7	4	2	4	3	5	5	5	5	4	5	3	3	5	4	5	4	6	5	3	6	2	3	3	4	2
Text 13	4	4	5	4	5	4	3	6	5	4	1	4	4	3	4	3	4	2	4	4	1	4	3	5	4	3	5	1	2	1	6
Text 14	4	3	3	3	3	5	2	5	5	3	2	5	3	4	3	2	3	3	4	5	3	3	3	5	3	3	5	3	3	6	3
Text 15	4	3	4	4	3	5	1	3	4	5	4	5	5	4	6	4	3	4	3	5	3	3	5	5	4	3	4	1	2	1	5
Text 16	4	4	4	4	2	4	3	5	3	3	4	4	5	5	3	4	3	4	3	4	5	3	5	5	3	3	3	4	2	4	4
Text 17	2	1	1	3	1	3	4	1	3	3	2	3	1	2	5	3	2	1	3	2	4	1	3	2	1	6	1	3	4	3	1
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Text 23	1	5	6	5	3	2	3	7	4	5	4	3	6	3	7	4	5	2	1	1	3	2	5	1	3	4	4	4	6	2	6
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Text 25	4	6	6	6	4	3	7	5	6	4	3	6	3	5	5	4	4	3	6	3	4	4	4	4	4	5	3	5	5	4	5
Text 26	4	2	2	2	1	3	4	1	4	3	3	5	2	4	4	3	2	3	5	3	5	3	3	4	3	6	1	3	4	4	2
Text 27	4	6	6	5	4	4	7	3	7	6	6	4	5	4	4	7	3	4	6	3	4	4	6	4	4	6	6	7	6	7	7
Text 28	4	2	2	4	1	4	4	3	4	3	6	5	4	6	2	6	3	4	5	3	7	4	6	4	3	6	3	2	3	5	2
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Text 30	4	4	4	2	2	2	3	4	6	3	3	4	2	5	4	4	3	2	4	4	4	3	5	4	3	3	3	4	4	4	3
Text 31	4	5	5	5	4	2	4	3	6	5	4	4	5	5	6	5	3	4	4	2	2	4	6	4	4	3	5	5	7	6	6
Text 32	4	5	5	6	3	3	4	4	5	6	4	4	4	5	4	5	5	3	3	4	4	4	7	4	3	4	3	4	4	5	6

Table 2 Continued

Raw Data Matrix

Subjects

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Text 34	3	2	4	2	5	5	2	2	2	2	3	5	4	3	4	1	4	4	5	4	5	5	2	4	4	5	5	3	3	4	4
Text 35	5	5	7	3	6	6	5	6	4	6	7	5	7	5	4	6	5	6	7	3	3	5	4	4	5	5	7	6	5	7	5
Text 36	5	4	4	3	5	6	2	5	3	2	6	5	5	5	5	5	4	5	5	6	6	5	4	4	4	5	4	2	2	5	4
Text 37	3	4	5	4	7	4	3	7	5	5	3	1	2	3	6	2	4	4	2	7	2	4	2	3	5	2	6	1	5	2	7
Text 38	5	3	3	4	4	5	2	6	3	4	3	4	4	4	4	2	4	4	2	7	5	4	1	3	4	2	5	3	4	3	4
Text 39	3	5	5	5	4	5	3	4	3	4	4	2	5	4	4	4	5	6	3	6	3	4	4	3	5	3	4	4	2	4	4
Text 40	5	4	2	4	4	4	1	3	2	4	4	2	6	4	3	4	5	5	3	5	4	5	4	3	4	3	5	3	5	5	5
Text 41	7	4	6	2	6	6	6	5	6	5	5	7	4	4	2	2	6	5	5	6	4	6	5	7	6	4	4	5	4	4	4
Text 42	7	3	3	2	5	5	6	2	4	1	5	7	3	3	1	1	4	5	5	6	6	5	4	7	6	4	4	2	6	5	3
Text 43	7	7	7	5	6	6	6	6	5	7	7	7	7	6	3	6	6	7	7	4	6	7	4	7	6	5	7	6	7	5	4
Text 44	7	3	2	5	5	6	5	2	4	2	6	7	7	5	1	6	6	6	6	5	7	7	4	7	6	4	2	2	2	6	2
Text 45	6	6	6	4	7	4	4	4	6	4	3	4	4	4	4	2	5	5	4	7	3	6	5	6	7	1	6	4	6	5	5
Text 46	6	4	3	4	7	5	4	4	5	1	3	4	3	4	2	2	7	5	4	5	4	6	3	6	6	4	6	4	3	6	3
Text 47	6	4	3	5	5	5	5	4	4	5	4	4	5	6	2	4	6	7	4	5	3	6	5	6	6	2	4	1	3	5	5
Text 48	6	4	4	4	5	4	5	4	4	1	4	4	5	5	2	4	6	7	4	5	5	6	5	6	6	2	3	4	3	6	4
Text 49	3	5	5	6	6	3	6	3	5	4	5	4	2	4	4	4	5	5	3	3	4	4	3	4	5	5	4	4	7	2	5
Text 50	3	2	3	4	5	3	2	2	2	2	5	4	1	3	4	3	4	4	3	3	5	4	2	4	4	5	4	3	3	3	2
Text 51	5	6	5	7	6	4	6	4	5	6	7	5	6	7	3	7	5	6	5	4	6	5	6	4	5	5	7	7	6	7	6
Text 52	5	2	4	6	5	4	4	2	3	3	6	3	4	6	3	6	4	6	5	4	6	4	4	4	4	5	2	2	3	5	2
Text 53	5	4	4	4	4	1	3	4	2	4	3	1	2	3	6	3	4	4	2	5	2	4	2	3	5	2	4	6	4	3	4
Text 54	5	5	3	5	4	2	4	4	2	2	3	2	2	3	5	4	4	4	2	4	2	5	2	3	4	2	3	5	4	3	3
Text 55	3	5	5	6	4	2	3	7	4	5	4	2	6	5	5	5	5	5	1	4	3	5	6	3	5	3	5	5	5	4	6
Text 56	3	6	3	6	4	3	5	6	3	6	4	2	4	5	3	5	4	4	3	5	5	5	4	3	4	3	4	5	4	4	5
Text 57	5	7	5	6	4	3	5	3	7	4	5	6	3	6	3	4	7	5	6	4	4	5	5	5	6	4	3	5	5	5	5
Text 58	5	3	3	6	5	3	4	2	6	2	5	6	2	6	2	3	4	5	6	5	4	5	5	5	5	4	2	3	4	6	3
Text 59	6	7	7	7	6	4	7	3	7	7	7	6	6	7	3	7	6	7	6	6	6	7	7	5	7	4	7	7	7	7	7
Text 60	6	3	1	7	5	4	6	3	6	3	6	6	5	6	2	6	6	6	6	5	7	7	5	5	5	4	3	2	6	5	2
Text 61	5	4	4	5	7	1	5	4	5	2	4	4	3	6	3	4	6	5	4	6	1	5	6	6	7	1	4	5	4	6	4
Text 62	5	3	4	3	4	2	5	4	4	1	3	4	1	3	1	4	5	4	4	6	4	6	3	6	5	1	4	6	4	4	3
Text 63	6	7	5	7	4	2	4	7	6	6	6	5	4	7	4	5	7	6	4	5	4	6	7	6	7	2	5	4	5	5	7
Text 64	6	6	4	5	4	3	7	4	5	6	4	6	4	7	1	5	7	6	4	6	6	6	7	6	5	2	5	6	5	6	5

Table 3

Repeated Measures ANOVA of CRT Text Models

Source	Sums of Squares	Degrees of Freedom	Mean Square	F	Tail Prob.
Mean	31720.00454	1	31720.00454	6992498.00	0.0000
1 Error	0.13609	30	0.00454		
RngHd	373.64970	1	373.64970	21.42	0.0001
2 Error	523.30343	30	17.44345		
Hdngs	0.84728	1	0.84728	0.07	0.7887
3 Error	347.66835	30	11.58894		
RngHd X Hdngs	0.18196	1	0.18196	0.24	0.6298
4 Error	23.02117	30	0.76737		
Cues	236.50454	1	236.50454	15.28	0.0005
5 Error	464.44859	30	15.48162		
RngHd X Cues	0.36744	1	0.36744	0.43	0.5161
6 Error	25.52319	30	0.85077		
Hdngs X Cues	13.72228	1	13.72228	12.16	0.0015
7 Error	33.85585	30	1.12853		
RngHd X Hdngs X Cues	2.00050	1	2.00050	2.25	0.1438
8 Error	26.64012	30	0.88800		
Spcg	64.23841	1	64.23841	4.50	0.0424
9 Error	428.65222	30	14.28841		
RngHd X Spcg	4.35937	1	4.35937	4.61	0.0399
10 Error	28.34375	30	0.94479		
Hdngs X Spcg	5.77067	1	5.77067	3.19	0.0841
11 Error	54.24496	30	1.80817		
RngHd X Hdngs X Spcg	0.84728	1	0.84728	0.94	0.3406
12 Error	27.10585	30	0.90353		
Cues X Spcg	0.48437	1	0.48437	0.47	0.5299
13 Error	35.96875	30	1.19896		
RngHd X Cues X Spcg	0.00050	1	0.00050	0.00	0.9763
14 Error	16.89012	30	0.56300		
Hdngs X Cues X Spcg	2.39970	1	2.39970	3.44	0.0735
15 Error	20.92843	30	0.69761		
RngHd X Hdngs X Cues X Spcg	2.00050	1	2.00050	2.91	0.0985
16 Error	20.64012	30	0.68800		

Table 3 (continued)

Source	Sums of Squares	Degrees of Freedom	Mean Square	F	Tail Prob.
Lgth	237.88760	1	237.88760	27.55	0.0000
17 Error	259.00302	30	8.63343		
RngHd X Lgth	0.48437	1	0.48437	0.45	0.5070
18 Error	32.21875	30	1.07396		
Hdngs X Lgth	19.96018	1	19.96018	9.40	0.0046
19 Error	63.68044	30	2.12268		
RngHd X Hdngs X Lgth	4.17389	1	4.17389	10.30	0.0032
20 Error	12.15423	30	0.40514		
Cues X Lgth	0.42389	1	0.42389	0.51	0.4815
21 Error	25.02923	30	0.83431		
RngHd X Cues X Lgth	0.93196	1	0.93196	1.19	0.2837
22 Error	23.45868	30	0.78196		
Hdngs X Cues X Lgth	1.52470	1	1.52470	3.01	0.0928
23 Error	15.17846	30	0.50595		
RngHd X Hdngs X Cues X Lgth	0.00454	1	0.00454	0.01	0.9200
24 Error	13.2612	30	0.44204		
Spcg X Lgth	12.7424	1	12.74244	8.96	0.0055
25 Error	42.6489	30	1.42161		
RngHd X Spcg X Lgth	0.26663	1	0.26663	0.55	0.4624
26 Error	14.4364	30	0.48122		
Hdngs X Spcg X Lgth	26.43196	1	26.43196	16.11	0.0004
27 Error	49.2086	30	1.64029		
RngHd X Hdngs X Spcg X Lgth	1.1134	1	1.11341	2.31	0.1391
28 Error	14.4642	30	0.48216		
Cues X Spcg X Lgth	0.31502	1	0.31502	0.60	0.4430
29 Error	15.6381	30	0.52127		
RngHd X Cues X Spcg X Lgth	0.0247	1	0.02470	0.03	0.8613
30 Error	23.8659	30	0.79553		
Hdngs X Cues X Spcg X Lgth	0.2666	1	0.26663	0.30	0.5863
31 Error	26.4364	30	0.88122		
R x H x C x S x L	2.9884	1	2.98841	7.78	0.0091*
32 Error	11.5272	30	0.38424		

Table 3 (continued)

Source	Sums of Squares	Degrees of Freedom	Mean Square	F	Tail Prob.
Para	136.81502	1	136.81502	18.81	0.0001
33 Error	218.13810	30	7.27127		
RngHd X Para	9.46018	1	9.46018	10.89	0.0025
34 Error	26.05544	30	0.86851		
Hdngs X Para	0.31502	1	0.31502	0.25	0.6176
35 Error	37.13810	30	1.23794		
RngHd X Hdngs X Para	0.69002	1	0.69002	0.95	0.3365
36 Error	21.70060	30	0.72335		
Cues X Para	5.14163	1	5.14163	5.53	0.0254
37 Error	27.87399	30	0.92913		
RngHd X Cues X Para	2.26260	1	2.26260	2.72	0.1094
38 Error	24.94052	30	0.83135		
Hdngs X Cues X Para	1.63760	1	1.63760	2.91	0.0983
39 Error	16.87802	30	0.56260		
RngHd X Hdngs X Cues X Para	3.47228	1	3.47228	5.52	0.0255
40 Error	18.85585	30	0.62853		
Spcg X Para	57.24244	1	57.24244	15.96	0.0004
41 Error	107.58569	30	3.58619		
RngHd X Spcg X Para	2.68599	1	2.68599	6.34	0.0174
42 Error	12.70464	30	0.42349		
Hdngs X Spcg X Para	0.01260	1	0.01260	0.01	0.9197
43 Error	36.56552	30	1.21885		
RngHd X Hdngs X Spcg X Para	0.54889	1	0.54889	1.47	0.2351
44 Error	11.21673	30	0.37389		
Cues X Spcg X Para	3.30696	1	3.30696	4.04	0.0536
45 Error	24.58367	30	0.81946		
RngHd X Cues X Spcg X Para	12.74244	1	12.74244	25.77	0.0000
46 Error	14.83569	30	0.49452		
Hdngs X Cues X Spcg X Para	0.54889	1	0.54889	1.63	0.2115
47 Error	10.09137	30	0.33638		
R x H x C x S x P	4.17384	1	4.17384	5.10	0.0313
48 Error	24.52923	30	0.81764		

Table 3 (continued)

Source	Sums of Squares	Degrees of Freedom	Mean Square	F	Tail Prob.
Lgth X Para	2.00050	1	2.00050	1.92	0.1765
49 Error	31.32762	30	1.04425		
RngHd X Lgth X Para	0.02470	1	0.02470	0.05	0.8290
50 Error	15.61593	30	0.52053		
Hdngs X Lgth X Para	5.77067	1	5.77067	7.72	0.0093
51 Error	22.43246	30	0.74775		
RngHd X Hdngs X Lgth X Para	1.21018	1	1.21018	3.75	0.0623
52 Error	9.68044	30	0.32268		
Cues X Lgth X Para	2.12954	1	2.12954	3.19	0.0841
53 Error	20.01109	30	0.66704		
RngHd X Cues X Lgth X Para	1.11341	1	1.11341	1.45	0.2372
54 Error	22.96472	30	0.76549		
Hdngs X Cues X Lgth X Para	3.30696	1	3.30696	8.30	0.0073
55 Error	11.95867	30	0.39862		
R x H x C x L x P	0.93196	1	0.93196	1.94	0.1737
56 Error	14.39617	30	0.47987		
Spcg X Lgth X Para	6.21018	1	6.21018	4.74	0.0373
57 Error	39.24294	30	1.30810		
RngHd X Spcg X Lgth X Para	2.00050	1	2.00050	4.70	0.0382
58 Error	12.76512	30	0.42550		
Hdngs X Spcg X Lgth X Para	2.00050	1	2.00050	3.19	0.0843
59 Error	18.82722	30	0.62759		
R x H x S x L x P	0.42389	1	0.42389	0.61	0.4408
60 Error	20.84173	30	0.69472		
Cues X Spcg X Lgth X Para	0.06099	1	0.06099	0.14	0.7097
61 Error	12.95464	30	0.43182		
R x C x S x L x P	4.94002	1	4.94002	9.55	0.0043*
62 Error	15.51310	30	0.51710		
H x C x S x L x P	1.63760	1	1.63760	2.28	0.1411
63 Error	21.50302	30	0.71677		
R x H x C x S x L x P	0.61744	1	0.61744	1.21	0.2805
64 Error	15.33569	30	0.51119		

Figure 1

Variable Conditions and Interactions

Conditions	RHCSL	RCSLP
Running Head: present (RH)	X	X
absent (RHN)		
Directive Cues: present (CP)	X	X
absent (CN)		X
Spacing (Leading): single (S1)	X	X
double (S2)		
Line Length: long (LL)		X
short (LS)	X	
Heading Location: embedded (HE)	X	
isolated (HI)		
Paragraph Indication: indented (PI)		
X		
spaced (PS)		

X = This condition was preferred significantly more than the other in the specified combination of text element variables.

Figure 2

RHCSL Interaction

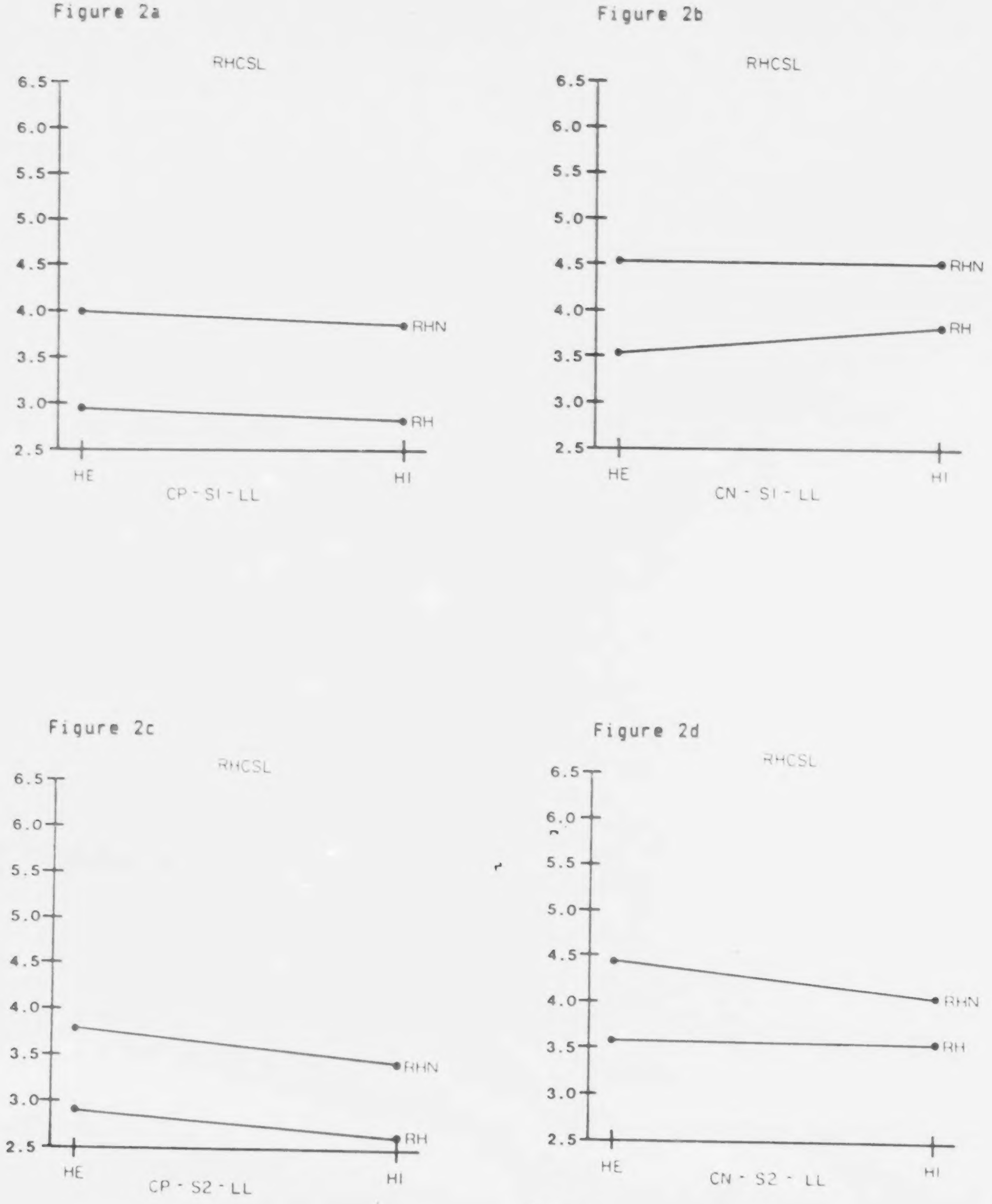

Figure 2a

Figure 2b

Figure 2c

Figure 2d

Figure 2 (continued)

RHCSL Interaction

Figure 2e

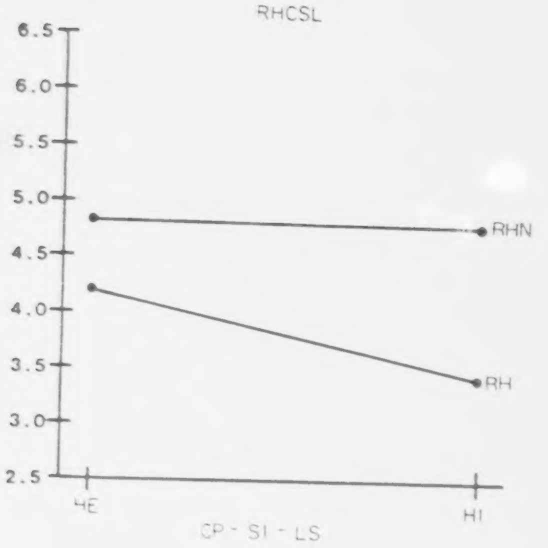

Figure 2f

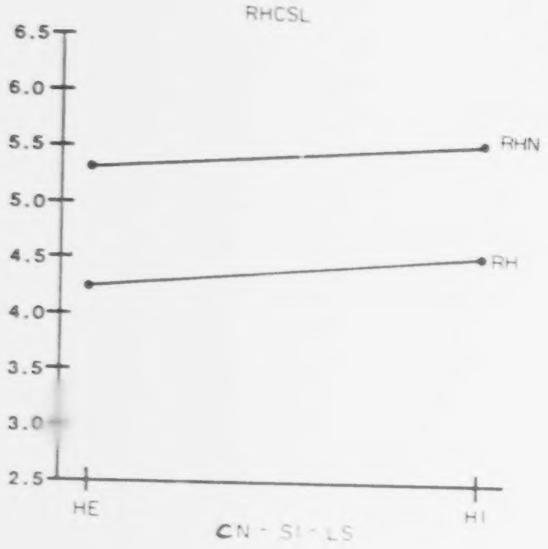

Figure 2g

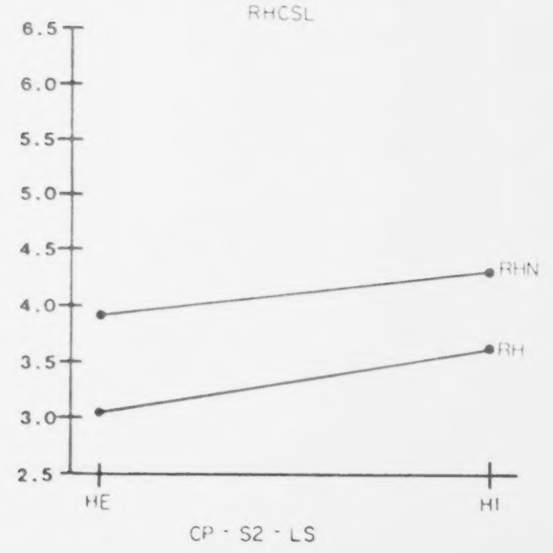

Figure 2h

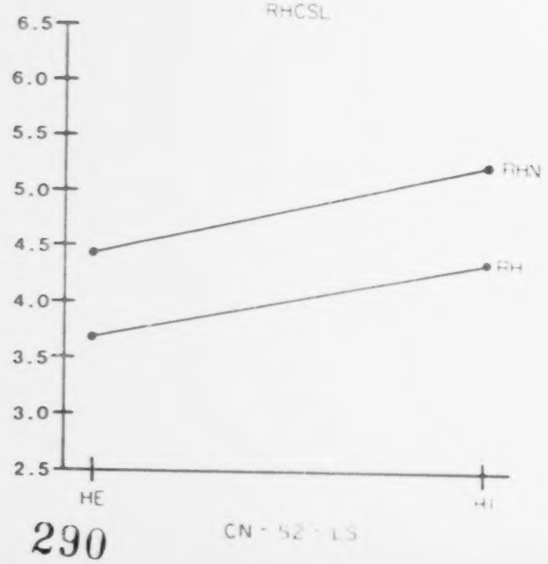

Figure 3

RCSLP Interaction

Figure 3a

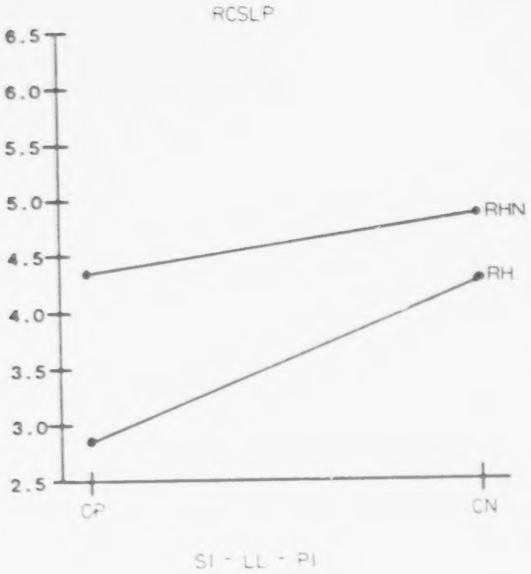

Figure 3b

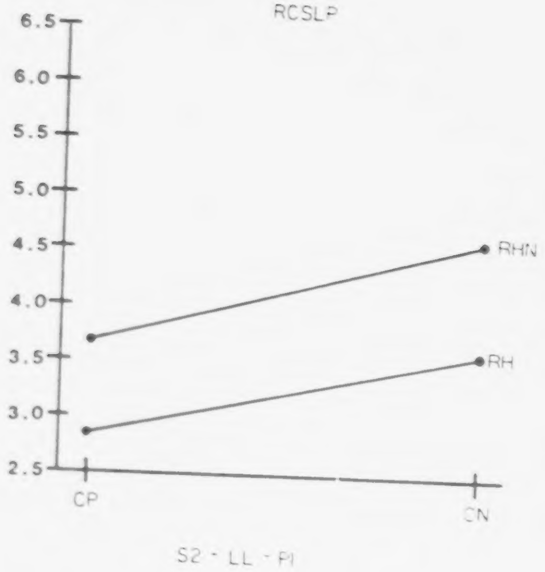

Figure 3c

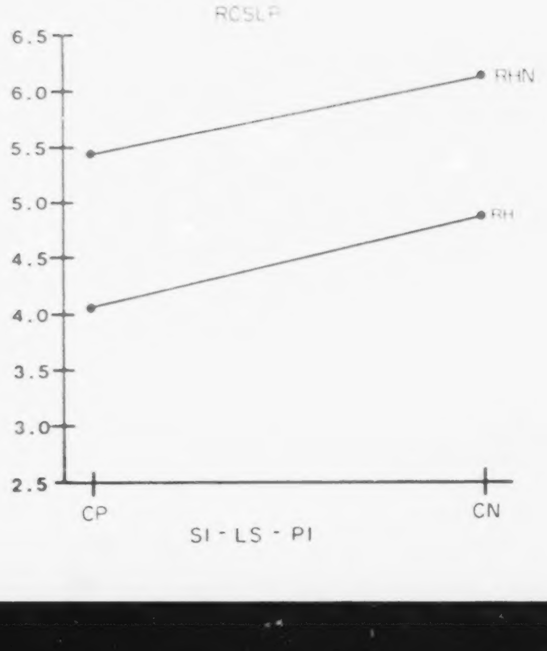

Figure 3d

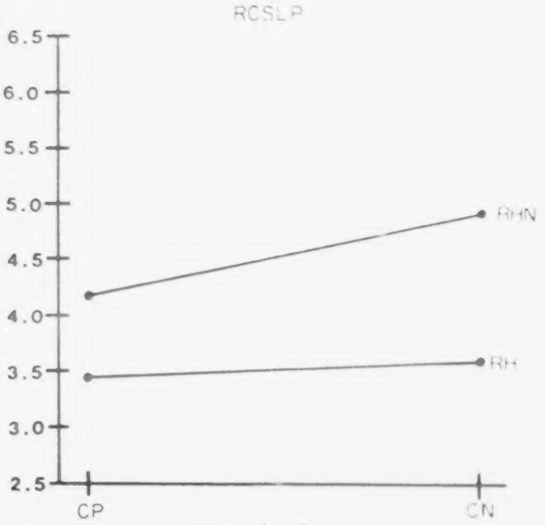

Figure 3 (continued)

RCSLP Interaction

Figure 3e

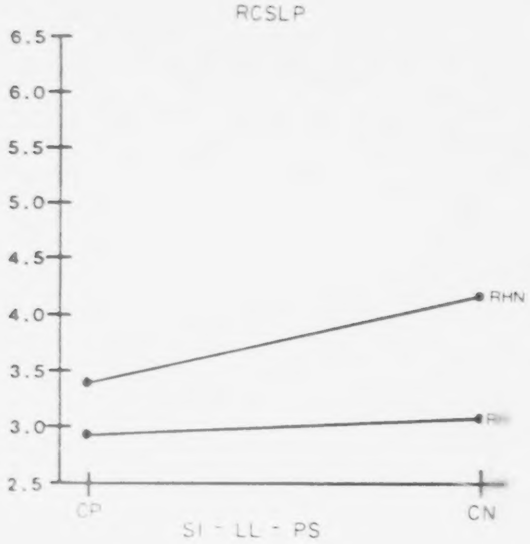

Figure 3f

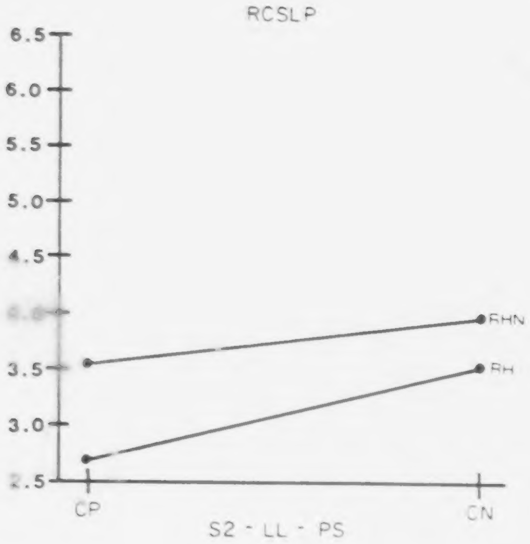

Figure 3g

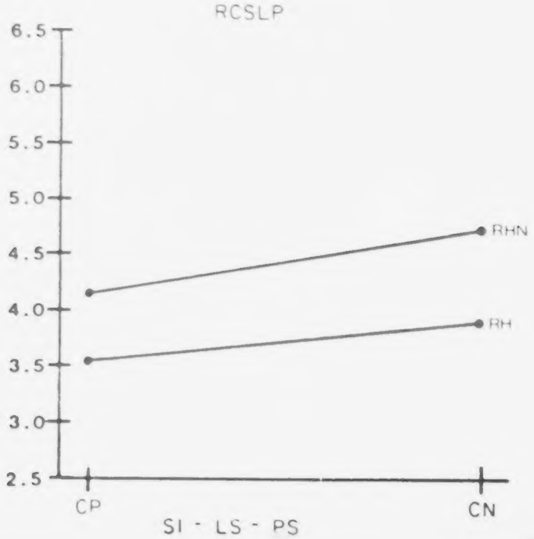

Figure 3h

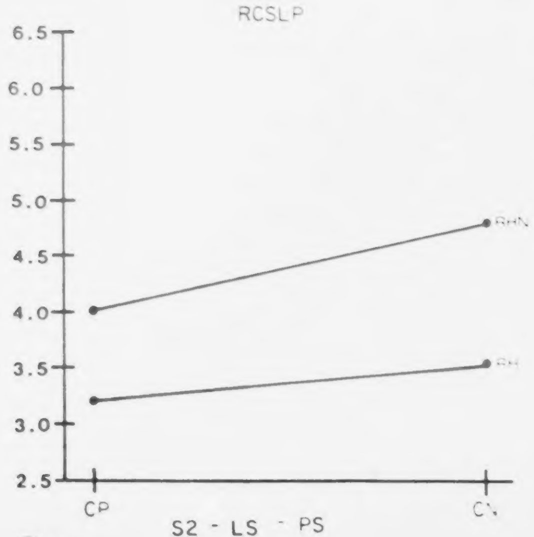

Table 4

Marginal Means of Study-ability Ratings

Running Heads Present	Running Heads None	Heading Locat. Embed	Heading Locat. Isolate	Direct. Cues Present	Direct. Cues None	Spacing Single	Spacing Double	Length Long	Length Short	Paragr. Indent	Paragr. Spaced
3.565		3.534		3.290		3.581		2.968		3.323	2.613
									4.194	4.387	4.000
							3.000	2.935		3.065	2.806
									3.065	3.129	3.000
					3.778	3.903		3.548		4.032	3.065
									4.258	4.613	3.903
							3.653	3.581		3.613	3.548
									3.726	3.710	3.742
			3.595	3.121		3.121		2.839		2.419	3.258
									3.419	3.774	3.065
							3.113	2.613		2.645	2.581
									3.613	3.774	3.452
					4.069	4.177		3.839		4.516	3.161
									4.516	5.129	3.903
							3.960	3.548		3.581	3.516
									4.371	4.419	4.323
	4.432	4.421		4.141		4.419		4.016		4.484	3.548
									4.823	5.290	4.355
							3.863	3.790		3.871	3.710
									3.935	4.000	3.871
					4.702	4.944		4.548		4.903	4.194
									5.339	6.000	4.677
							4.460	4.468		4.742	4.194
									4.452	4.484	4.419
			4.444	4.060		4.266		3.758		4.258	3.258
									4.774	5.581	3.968
							3.855	3.419		3.452	3.387
									4.290	4.837	4.194
					4.827	5.008		4.500		4.839	4.161
									5.516	6.226	4.806
							4.645	4.065		4.387	3.742
									5.226	5.323	5.129

EXTENDING GRADUATE LEVEL EDUCATION: A MANAGEMENT MODEL

by Robert L. Hales & Stephen B. Felt

Goals and Objectives

Project Goal: To develop a delivery system that is capable of transferring professional, graduate-level education programs having identical content to those presented on university campuses to adult audiences off campus. The model must be inexpensive, flexible, easy to use, and capable of a high degree of educational transfer.

Our original search for technology to facilitate the delivery system included both video and audio formats. Since video cassette players are not universally available, we turned to audio cassette technology. It offered the following advantages for distance education:

1. Universal availability
2. Low cost for players and cassette tapes
3. Portability, ease and convenience of use
4. Independence from broadcast schedules and bad weather
5. Learner control of place and time of information transfer

We felt that these attributes would be significant in using technology as a bridge to carry courses to distant students and to extend the influence of our most popular and capable faculty.

A review of the literature indicates that distance education, as provided by the various Open Universities, has been focused at the undergraduate level. By emphasizing the postgraduate level we are targeting the needs of college alumni who are seeking additional training.

Replacing Interaction with Structure

In the traditional classroom, patterns of interaction exist between teacher and students, and between individual students. When we remove the instructor and other class members from the learning process and incorporate a technological bridge (in this case audio cassettes) we are taking away the interaction and replacing it with structure. We are interested in exploring the effects on learning when the interaction between students and instructor is not present. We are looking for answers to the following questions:

1. How is this type of learning experience going to compare or compete with personal classroom instruction?
2. Will the adult professional be motivated by a prerecorded audiotape of graduate level course work?
3. Will the lack of a regularly scheduled class meeting time influence the students ability to pace themselves.
4. Will the educational value of the course be sufficient to justify offering university credit?

What Research has to say about Rapport and Pacing

Physical proximity of instructor to learner has a causal effect on the learning relationship in at least three ways:

1. Verbal and non-verbal clues facilitate the interpretation of information.

2. Rapport with instructor affects the intensity with which the student participates in the learning process.
3. Pacing, through regular instructor contact, directs effort toward regular achievement.

Audiotapes transfer only the audible clues through modulation. The experimental model and testing data is designed to indicate the effectiveness of the information transfer. In this model the only element of pacing is provided in the deadlines for handing in assignments, and contact with proctors.

Significant to this experiment is our capture of the actual classroom experience on the audiotape rather than a dramatization or special version recorded by professional readers. We think this will add credibility to the course and make it more acceptable to universities.

There is some indication in the literature of rapport being vicariously attributed to the tape. A survey has been created to obtain data on what rapport exists as a result of this course, and what importance the expertise of the instructor may have.

Survey of Experimental Group

In the survey we attempt to evaluate specific elements of rapport, pacing, and attitude towards the course as shown in the following questions:

1. Do you see this course as being helpful in your current employment or future career? Explain.

2. What is your evaluation of the expertise of the instructor?
3. Would regular contact with the instructor have motivated you to complete assignments sooner? Explain
4. Did the taped version of the course offer any advantages over your past experience in a class room setting?
5. Would a more structured course with dates given for the completion of each lesson and assignment be helpful?

After reviewing the available research in the area, we will now move on to our research design and preliminary findings.

Research Design

This research was undertaken with the object of finding a delivery system that can provide high-quality instruction to the twenty three million college graduates currently living in the United States. Many of these people wish to continue their education but are hindered by rigid university standards which require residency in daytime campus programs. For those individuals who are working during the day there are few, if any, options open for graduate-level education. If a delivery method can be found for distance learners that will maintain the quality and the academic content of the day school campus class, the universities may be influenced to allow credit for these courses and thus meet a great need of their alumni.

To guarantee the academic quality and content of the course we felt that it was necessary, so far as was possible, for the distance learner to have the same academic experience as the on-campus student had. We theorized that if this could be properly done, the motivation and additional experience of the off-campus learners might compensate for any disadvantages in the delivery system. After some deliberation it was concluded that an audiotape transcription of the day class might meet this requirement. The tape can deliver all of the instruction and student input that takes place. Everything that the day student hears in the class will be conveyed in identical language to the distance learner.

Our next step was to allow for the visual information. We planned to accomplish this by having a class member carefully copy all of the static visuals used in the class. The chalkboard and overhead projector are most commonly used for visual-instructional support at the university. Copies of the visuals used will be included with the class hand outs in a student syllabus. Headings and lesson numbers on each visual will match it with the appropriate lesson.

Next we needed to select a course to tape. A survey was made to ask local high-level corporate managers which graduate courses from the School of Management's catalog they felt would have the greatest value for management-level personnel in their organizations. An MBA course which was highly ranked in the survey was selected. Titled "Management Philosophy and Style", it was taught by a thirty year veteran professor who had recently been the Dean of the School of Management at BYU. Permission was obtained to audiotape the course during the next semester.

We talked to the instructor and learned the course content and requirements. Then we were ready to develop a research design. Professional help was obtained from a faculty consultant in the Statistics Department. He suggested that we compare the test results from both the midterm and the final exams taken by the campus students with the same exams taken by the off-campus group. Since graduate courses usually have smaller enrollments than the undergraduate classes, we decided to use a T-test for comparisons. A box plot is also planned to assist us in further examining the data. We will keep copies of all of the tests before they are graded. Then, after deleting all names or identifying information from each test we will assign it a number. The tests will all be corrected at the same time by one grader who has been trained for this assignment by the instructor. This person will have no way of identifying either the student who wrote the test or the group to which that student belongs while the tests are being graded. The identifying numbers will be used to separate the two groups scores for the statistical comparison.

Conducting the Experiment

With the design in place we now proceeded to tape the course. A good quality reel to reel recorder was used. We used a two track recording system with a lavalier mike on the instructor and two additional mikes on stands in the room to pick up student input. The taping went well except for the background noise we picked up from the classroom mikes on one of the tracks. We had an average attendance of eighteen students in the course. An observer in the classroom copied all of the visual information used in the class for the student syllabus. He also took notes on student attendance, the number of students who asked questions or participated in class and other items of this nature. The instructor relied on the chalkboard exclusively and no films, slides or transparencies were used.

After completing the taping we decided to make two versions of the course. The first version would contain the entire course with all of the lectures, class discussion and group sessions. The other version would have the student comments, questions and group discussion sessions edited out. In this way we hope to determine whether or not the student interaction is a valuable part of the course for the distance learner. We edited out as much of the background noise as we could. At the end of this process we had two versions of the course available in three different formats; the reel to reel format, the standard cassette format, and a special slow speed format selected because it gave us the advantage of putting the whole 30 hour course on three cassettes. Now we needed a test audience.

We explained our project to training directors and two corporations agreed to furnish us some management-level volunteers, randomly selected to take the course. We ended up with fifteen students for the first trial. Each one was asked to recommend a proctor to give them the exams and to send us the information necessary to make the test arrangements. Students were given the same information and course requirements that the campus class received. Added to their instructions was a brief explanation on how to use the special long play recorder that was included in the course package. The students were given a schedule of when the testing periods would be and when assignments were due. Tests will be mailed out to a proctor at the company who will administer the tests and return them to us.

The experimental course is now underway with a small group of students. We are beginning to get the data back. We have received the midterm examinations from most of our test group. These papers are being graded by a competent grader and returned in order that the students can get feedback from their work. This preliminary information is helpful in making some early predictions. The research data for the statistical model will come from a second grading of the tests done later by a different grader. Because of the small sample we are dealing with, we recognize that the results that we obtain are not conclusive. We expect to gather data from many more students to give validity to the study.

Preliminary Findings

The limited information that we currently have suggests the following:

1. Distance learners in this study will generally achieve higher scores on the examinations than the graduate students who took the course on campus. Their field experience has given them a depth and breadth that doesn't show up in the university student's tests.

2. Information from the distance learners indicates that if this course could be offered for university credit, it would be of interest to more people and provide a greater motivation for the participants to complete it. We have received several expressions from people saying that this method of distance learning provides exactly what they have been looking for to further their education and their career. This suggests a market for courses of this type particularly if universities will make them available for credit.

3. The delivery system involved here limits the course offerings to classes that are not highly interactive. If this delivery system were to be used in a degree program, a combination of both campus and distance learning experiences would be desireable. Further studies are planned to determine if this delivery system, coupled with videotapes, can successfully convey the educational content for courses requiring laboratory experiences.

4. With some testing and modification, this model has the potential to meet the needs of many adult learners. It could create a significant market for those universities and colleges who chose to incorporate it as an alternative in their graduate course offerings.

5. The low cost of production and distribution of this delivery system make it capable of a high degree of profitability in the event it adequately meets the expectations previously described.

While there are many ways of extending professional distance education courses to adult audiences, this one has the potential of receiving university approval for credit. We hope that it will provide a much-needed option not presently open to most adult learners.

Note: The data from this research will be available in the early spring of 1986 and the outcomes of the study should be ready soon afterwards. For a copy of this information send $2.50 to cover postage and handling to:

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A COMPARISON OF TASK ANALYSIS, ADVANCE ORGANIZER, AND CONCEPT ELABORATION METHODS IN TEACHING CONCEPTS AND PRINCIPLES

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Instructional design should be viewed in relation to the other areas of inquiry within education. Beauchamp (1968) states that education is comprised of knowledge about instruction, curriculum, counseling, administration, and evaluation. Snelbecker (1974) compares the areas of curriculum and instruction by stating that curriculum is concerned primarily with "what" to teach while instruction is concerned with "how" to teach. Looking more specifically at the area of instruction, Reigeluth (1983) views it as being comprised of five major activities: design, development, implementation, management, and evaluation. He further states that each of these professional activities has an associated discipline which is an area of inquiry concerned with improving the performance of each activity with optimal results.

Instructional Design

Gordan (1968) defines instructional theory as "a set of statements based on sound replicable research, which would permit one to predict how particular changes in the educational environment would affect pupil learning" (p.3). Mayer (1981) states that because of the explosion of useful knowledge concerning human cognitive processes and memory structure within the past 10 years, instructional theory should be based on cognitive theory.

The quest for the development of broadly acceptable instructional theory has led to a growing interest in the design science of instruction (Glaser, 1976; Reigeluth, Bunderson, & Merrill, 1978). The goal of this new science is to develop a cadre of those prescriptive principles of instruction which may be applied by instructional designers and evaluators. Reigeluth and Merrill (1979) state that when a sufficient number of these principles have been identified, defined, and validated instructional designers can then prescribe methods that will optimize learning for a given set of conditions. In addition, when a set of models of teaching can be developed from these principles, they can then comprise a basis for an acceptable prescriptive theory of instruction (Reigeluth & Darwazeh, 1982).

Task Analysis

A widely researched aspect of designing instruction deals with structuring and sequencing information. Structure refers to the general organization of instruction while sequencing "refers to the design decisions pertaining to the order in which subject matter is presented (ie., the relationship of concepts and principles within a knowledge domain), which build upon existing cognitive structures to produce new or elaborated cognitive structures" (Tillema, 1982, p.170). A major researcher who has helped to shape this area of study is Robert Gagne (Merrill, 1977). His theory, known as the cumulative learning theory (Gagne

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1968a), is based on the construction of learning hierarchies for the purpose of systematically organizing information to be learned through an analysis of the final task or behavioral outcome of the instruction.

More specifically, this task analysis begins with the final behavioral task from which all subordinate capabilities are identified. The hierarchical relationship of these capabilities is then organized by evaluating what the individual would have to know how to do in order to exhibit this new capability or task (Gagne, 1968b).

The levels of these capabilities in the hierarchy are then related to the levels of learning (Gagne and Briggs, 1974), where each capability corresponds to a type of learning classification, ie. problem solving, principle learning, concept learning, multiple discrimination. Each level or type of learning is also designed as being prerequisite to the one above and, therefore, must be learned before the student can go up the structure to successfully complete the desired task.

This analysis of prerequisite learning is necessary when designing sequences of instruction. Although the learning hierarchy itself does not directly present the desired or needed sequence of instruction, according to Gagne and Briggs (1974), it represents a kind of intuitive logic which provides a meaningful context for a design.

Concept/Principle Learning

The teaching of elaborate concepts and principles may pose difficulties for the application of learning hierarchies. These types of learning often require the synthesis of a multitude of obscurely related concepts or ideas whose relationships do not fit into a traditional linear sequence.

Tennyson and Boutwell (1974) define a concept as a class of objects or ideas which are characterized by the same critical attributes. If the definition is applied to a task analysis method of learning, a subject would have to exhibit competency in three major task levels: 1) remembering an instance, 2) remembering a generality, and 3) applying a generality (Merrill, Reigeluth & Faust, 1979; Merrill & Tennyson, 1977). A generality is defined as an abstract or general statement that can be applied to a variety of specific situations, such as the definition of a concept or the statement of a procedure. An instance is defined as a specific object, event, or symbol such as an example of a concept or an application of a procedure.

Reigeluth and Merrill (1979) define a principle as an operation which "specifies a cause-and-effect relationship among several event concepts" (p.14). The use of principles is generally found in the teaching of large amounts of information or macro-strategies which Reigeluth (1979) defines as "ways of organizing those aspects of instruction which relate to more than one topic, such as sequencing the topics, showing interrelationships among the topics, and

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previewing or reviewing the topics" (p.8).

Two models of teaching which deal specifically with the presentation of large amounts of information or macro-strategies are the "Advance Organizer" (Ausubel, 1968) and the "Concept Elaboration Model of Instruction" (Merrill, 1977).

Advance Organizer

One model of teaching advocated for use in task analysis is the "Advance Organizer" (Gagne & Briggs, 1974). This model, based on the theory of meaningful learning, has been a topic of research for the past 15 years. Joyce and Weil (1980) state that the primary goal of the advance organizer is to convey large amounts of information in as meaningful and efficient a manner as possible. Therefore, the advance organizer is well designed to teach concepts and principles which require the synthesis and assimilation of subconcepts and facts into broader, more meaningful thoughts. Ausubel (1968) defines advance organizers as "appropriately relevant and inclusive introductory materials... introduced in advance of learning... and presented at a higher level of abstraction, generality, and inclusiveness" (p.148). Ausubel (1977) further states that the function of the organizer is "to provide specifically relevant anchoring ideas for the more differentiated and detailed material that is subsequently presented" (pp.167-68). This organizer may then represent a design for the optimal sequencing of those competencies necessary to successfully teach the desired principle, concept, or fact. Mayer (1979) presents five major characteristics of the advance organizer:

> (1) Short set of verbal and visual information; (2) Presented prior to learning a larger body of to-be-learned information; (3) Containing no specific content from the to-be-learned information; (4) Providing a means of generating logical relationships among elements in the to-be-learned information; (5) Influencing the learner's encoding process. (p.382)

Essentially Ausubel (1978) has identified two types of advance organizers: the expository organizer (which is used to teach completely new material) and the comparative organizer (which is used to teach familiar or relatable ideas). In both models the bulk of the synthesizing information is presented at the beginning with a brief reinforcement synthesis or summary at the end of the presentation of information.

One important characteristic of an advance organizer is that it is not designed as a summary or an overview. Summaries or overviews are presented at the same level of abstraction, generality and inclusiveness as the learning materials themselves. "They simply emphasize the salient points of the material by omitting less important

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information, and largely achieve their effect by repetition and simplification" (Ausubel, 1968,p.148). The goal of the advance organizer, in contrast, is to prescribe a cognitive framework within which all subsequent instruction may logically fit.

Concept Elaboration

Another distinctive task analysis model of teaching and theory is the "Concept Elaboration Theory of Instruction" (Merrill, 1977). Like the advance organizer, concept elaboration prescribes a framework within which concepts, principles, or procedures may reveal logical order. However, unlike the advance organizer, in which the entire organizing structure is presented at the beginning and end of the instructional process, the concept elaboration model intersperses its organizers or epitomes throughout the entire instructional experience by moving from a general-to-detailed sequence of instruction. Reigeluth (1979) draws an analogy with the process of zooming in and out of a camera lens. In order to see all of the parts of the picture, a person starts with a wide angle view of what is to be learned. Then the person zooms in on one part, halting the zoom at different levels, to study the interrelationships of the explored part with the other parts of the picture. After part of the picture is satisfactorily explored or elaborated, the person zooms out and repeats the process with another part. After all of the significant parts of the picture have been explored, the person zooms back out to the wide-angle position. At this point, the broadest topic of the instruction, or epitome, will be satisfactorily understood.

Reigeluth and Darwazeh (1982) define an epitome as "an overview of the relationship between principles, concepts, objects, events or ideas which are presented at an application level including generalities, examples and practice" (p.31). The definition is again uniquely distinctive from the advance organizer in that it does not emphasize "higher levels of abstraction, generality, and inclusiveness" (Ausubel, 1968,p.148). Instead, it describes exactly what an advance organizer does not do, ie. which "emphasizes the salient points of the material... and achieve their effect by repetition and simplification" (Ausubel, 1968,p.148). The concept elaboration model uniquely presents the epitomes or organizers at every level of elaborative instruction instead of only at the beginning and end of the presented information. The elaboration style of structure and sequence, therefore, naturally incorporates increasingly higher levels of abstraction, generality, and inclusiveness through a continual synthesis of information throughout the entire presentation.

An example can be found in creative writing. If a writer applies in greater detail the relationship between plot, theme, and characterization, his/her creative writing style

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improves. The concept elaboration model assists the student writer by presenting the cognitive information and relationships of this information at each deeper level of the learning experience. Since this is an application approach, the student practices what he/she has learned at each level of elaboration. The result increases the students field of experience and lays the foundation for deeper investigation and understanding.

From these ideas, definitions, concepts, and principles the two structure and sequence models may be compared.

Related Research

Three major reviews (Barnes & Lawson, 1975; Mayer, 1978; Faw & Waller, 1979) and four critiques of the reviews (Lawton & Wanska, 1977; Ausubel, 1978; Mayer, 1979; Kozlow & White, 1980) have been written about advance organizer research within the past nine years. To date there are few reviews of concept elaboration research.

In a review of concept elaboration as an emerging instructional theory, Mayer (1981) states that "in some ways the epitome is like the advance organizer, because it is intended to provide a general context for all new incoming information" (p.23). He further states that the analogical model and assimilative context for learning of the advance organizer have a relationship with the sequencing, synthesizing and summarizing components of the elaboration theory and that this relationship needs to be explored in more detail.

Mayer (1981) states, "It strikes me that the definition of an epitome should be consistent with what we know about the characteristics of advance organizers" (p.25). Therefore reviews on advance organizer research will be used to make inferences about research related to concept elaboration. The critiques (Lawton & Wanska, 1977; Ausubel, 1978; Mayer, 1979; Kozlow & White, 1980) of the reviews of earlier advance organizer research addressed the five following major problems as cited by Weil and Murphy (1982):

1) test measure incompatability (Ausubel, 1978; Mayer, 1979). Most studies used tests measuring verbatim recall and ignored meaningful verbal learning and long term retention;

2) failure to control for existing subsumers in cognitive structure (Lawton & Wanska, 1977; Ausubel, 1978; Mayer, 1979; Kozlow & White, 1980). Lack of control for existing subsumers renders the effectiveness of the advance organizer model impossible to ascertain because subjects may have already possessed the prerequisite knowledge;

3) failure to assess the presence of appropriate bridge cognitive structure (Ausubel, 1978; Mayer, 1979; Kozlow & White, 1980). Subjects may lack the ideational scaffolding necessary to utilize the advance organizer;

4) failure to show that learners used relevant subsumers (Lawton & Wanska, 1977; Mayer, 1979); and

5) failure to analyze whether the main concept in the

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advance organizer is an appropriate subsumer for the information in the learning material (Kozlow & White, 1980). An analysis of the conceptual content in relation to structure and sequence of the instruction to be learned is necessary before conclusions can be drawn.

In addition, another major problem found in this advance organizer research is an inequality in instructional treatment time between control and experimental groups (Weil & Murphy, 1983; Wilcox, Merrill, & Black, 1981).

Background of the Study

Although task analysis has been a subject of research for many years, there is little consensus (Carlisle, 1983) about what "task analysis" means or how a task analysis should be done. Davies (1973) describes task analysis in terms of its subtasks. These subtasks are used to design instruction which will reduce error in human performance. This process (Patrick & Stammers, 1978; Carlisle, 1982b, 1983; Springer & Powers, 1983) primarily requires a:

1. breakdown of the task, content etc., into constituent elements;
2. determination of the relationships among the elements; and
3. restructure in accordance with the underlying principle or optimal learning design.

The models of teaching which apply this process of task analysis are numerous and varied in their design. Two task-analysis based models dichotomous in their design are "Advance Organizer" and "Concept Elaboration." Both of these models are espoused as being reliable for teaching large concepts or principles. The advance organizer may be described as presenting synthesis instruction at the beginning of a presentation, logical sequence of instruction throughout the body of the presentation, and synthesis and/or summary instruction at the end of the presentation. The concept elaboration model, in contrast, presents synthesis, logical sequence, and summary instruction throughout the entire presentation by weaving them together at each elaborated level of instruction.

The Problem

The "Concept Elaboration Model of Instruction" has been linked closely with the "Advance Organizer" (Mayer, 1981). These two models may be defined as parallel in their design but divergent in their application. One major distinction is that the advance organizer presents its synthesizing and summarizing information at the beginning and end of the instruction. The concept elaboration model, on the other hand, emphasizes its synthesizing and summarizing information throughout the entire instruction, drawing interrelationships among all of the concepts, ideas,

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objects, and events at each level of the elaboration.

One goal of instructional design research (Reigeluth & Merrill, 1979) is to develop a cadre of prescriptive principles which will organize information for instructional purposes. Task analysis is one method of analyzing information for instructional purposes. This analysis of information is applied primarily through the development of a learning hierarchy. It is the purpose of the learningg hierarchy to graphically represent all of the specific levels of learning related to the instructional content. This hierarchy, containing the detailed information to be taught, will then provide a context for the design of instruction. Two models of teaching which use this task analysis approach are "Advance Organizer" and "Concept Elaboration."

The advance organizer model as described by Ausubel (1968) is designed to teach information through provision of "ideational scaffolding for the stable incorporation and retention of the more detailed and differentiated material that follows" (p.148). According to Reigeluth (1979), concept elaboration is primarily designed to teach information through macro-strategies which are "ways of organizing those aspects of instruction which relate to more than one topic, such as sequencing the topics, showing interrelationships among the topics, and previewing or reviewing the topics" (p.8). However, there is little or no research related to the efectiveness of the concept elaboration model of teaching. There is also little research (Wilcox, Merrill & Black, 1981) which explores these sequencing, synthesizing, and summarizing approaches to teaching concepts and principles.

From a historical perspective this general-to-detailed approach to designing instruction has substantial support. The spiral curriculum, as described by Bruner (1960), explains how anyone can be taught something about any topic of study, as long as the information is presented at the learner's appropriate reception level. Additional research on schema theory (Anderson, Spiro & Montague, 1977; Collins & Quillian, 1970; Lindsay & Norman, 1977; Rumelhart & Ortony, 1977) based on Ausubel's meaningful learning theory and Norman's (1973) web of learning based on Bruner's approach to the spiral curriculum have further advanced research in this area.

With the recent introduction of concept elaboration into the literature, Mayer (1981) states that there is a need for empirical support to further analyze and develop the theory. Mayer further notes that the relationship between the structure and sequence characteristics of the advance organizer and concept elaboration models needs to be explored in more detail.

Purpose of the Study

One of the purposes of instructional design research is to

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validate the use of instructional principles. According to Reigeluth (1983) and Mayer (1981), the instructional principles of sequencing, synthesizing, and summarizing as they relate to teaching concepts and principles via the advance organizer and concept elaboration models of teaching are in need of exploration.

Therefore, the purpose of this study is to compare the advance organizer and concept elaboration models of teaching with a task analysis approach. This will be accomplished by ascertaining if persons given synthesis and summary instruction at every sequential level of an instructional program will achieve differently from persons given synthesis instruction only at the beginning and synthesis/summary instruction at the end of an instructional program. These two approaches will also be compared with persons given a logical sequence of instruction absent of any synthesis or summary. To maintain the integrity of each approach, all instruction will relate to the same concepts and principles.

Design of the Study

Because of the limited research in this area a need exists to perform an investigation to identify if different levels of achievement exist between subjects instructed through varied approaches of sequencing, synthesizing and summarizing information. One method of investigating these potential differences is to develop three instructional programs for the same topic of study. The first program is to be based on a general task analysis approach. This will be used as a basis for the development of advance organizer and concept elaboration programs.

If these three instructional programs of task analysis, advance organizer and concept elaboration are administered to randomized subjects, then the levels of achievement measured by a common evaluation instrument will determine the effectiveness of each model of instruction.

Limitations

Although the study will compare the advance organizer and concept elaboration models of teaching, it will compare primarily the effects of the three characteristics of sequence, synthesis, and summary common to both models. Although these are major characteristics of the models, the results will in no way reflect the greater value of one model over the other for all conditions. Instead, the significance of these results will relate only to the teaching of concepts and principles.

It need also be noted that the Advance Organizer and Concept Elaboration Theory of Instruction are primarily designed to incorporate macrostrategies or numerous teaching sessions in their design. A distinction needs to be established where a microstrategy begins and a macrostrategy ends. Examples of the models by Reigeluth (1979) and Joyce

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and Weil (1980) present them to be open to interpretation. For instance, the teaching of the principle of supply and demand may be the foundation for a series of sessions in a course or a single session in a course. The importance relates to the depth of learning that is necessary and the ability of the audience to quickly understand the information being presented. This study will deal with the presentation of microstragies or a single presentation of information as described by Joyce and Weil (1980). The pragmatic utilization of these models of teaching is necessary if the instructional theories are to have broad-based application to teachers and instructional designers.

The Study

it was hypothesized that the concept elaboration group would achieve significantly higher than (a) the advance organizer group and (b) the task analysis group on concept learning and principle learning when evaluated upon completion of instruction. It was further hypothesized that the advance organizer group would achieve significantly higher than the task analysis group on concept and principle learning upon completion of instruction. It was also expected that similar results would occur when assessed with an equivalent evaluation form 5 weeks after instruction.

The sample was comprised of 92 undergraduate teacher education students who were exposed to one of three instructional treatments related to task analysis, advance organizer, and concept elaboration. The three treatments were validated and pilot tested. All of the hypotheses were supported from the results of the pilot study.

This investigation required subjects to take two posttests. One was taken upon the completion of instruction; the second were taken five weeks after instruction. Each posttest consisted of fifteen questions related to concept learning and fifteen questions related to principle learning. To insure accuracy of the instruments, a Kuder-Richardson (KR-20) produced evidence of a reliability of .840 and .804 in Posttest 1 (T1) and Posttest 2 (T2) respectively.

All posttest results were then reported as: A. the sum total of concept learning in the first postest (CON-T1); B. the sum total of principle learning in the first posttest (PRIN-T1); C. the sum total of concept learning in the second or delayed posttest (CON-T2); D. the sum total of principle learning in the second or delayed posttest (PRIN-T2); and E. the sum total of both concept and principle learning (CON/PRIN-T1/T2).

In addition posttest 1 (T1) and posttest 2 (T2) scores were compared for achievement according to the categories of A. concept learning and B. principle learning.

Findings Related to the Hypotheses

The final study was performed on a summer school population

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which required additional control of potentially confounding variables. To control for the preidentified independent variables, a series of One Way Analyses of Variance (ANOVAs) was performed using the variables of A) levels of achievement, B) levels of experience, C) gender, and D) age. The one variable of age was found to have a significant effect. This variable was then Covaried using Analysis of Covariance (ANCOVA) for the remaining results.

A one-way analysis of variance was performed on the four independent variables of achievement (GPA), levels of experience, gender and age. The only significant finding occurred with the variable of age. An analysis of a post hoc student Newman-Keuls reported a significant difference in age between the task analysis control group and the concept elaboration group.

After the effect of of age was covaried, the remaining results found the task analysis group to achieve significantly higher (.05 level) than the advance organizer and concept elaboration groups in (a) concept learning upon completion of instruction and (b) principle learning 5 weeks after instruction. The task analysis group also achieved significantly higher (.05 level) than the advance organizer group in principle learning upon completion of instruction.

The results of concept learning 5 weeks after instruction found no significant difference in achievement between any of the groups.

Therefore, the task analysis group, containing only a recommended sequence of instruction, achieved significantly higher than the advance organizer and concept elaboration groups, containing variations of sequencing, synthesizing, and summarizing of instruction, in five of eight evaluation instruments. All of these findings were in direct contrast to those anticipated, based on earlier pilot results.

Conclusions

From the findings, it is concluded that:

1. Given the sample and instructional programs, the task analysis approach appears to be a more effective method of instruction than concept elaboration or advance organizer in teaching concepts and principles.

2. Given the sample and instructional programs, neither advance organizer nor concept elaboration appear to be superior to the other as an instructional strategy.

3. As an unanticipated outcome of the study, age is apparently a more important factor in determining appropriate instructional strategies than previously expected.

Discussion

The findings of this investigation support the superiority of a task analysis approach to teaching over the advance organizer and concept elaboration models. These findings are in conflict with the pilot study results and the proposed hypotheses for this study.

Based on the literature, a need exists to examine the conclusions in greater detail. First, a need exists to examine through the literature why task analysis may be a superior approach to teaching concepts and principles. Second, a need exists to explore what research or theoretical assumptions related to advance organizer or concept elaboratioin are either confirmed or questioned. Third, a need exists to describe the effect of age on the study and compare that effect with other research.

Superiority of Task Analysis

Since the task analysis group emerged superior to the advance organizer and concept elaboration groups, it may be concluded that it is a superior design of instruction for the samples and treatments in this study. In the final results, the task analysis group emerged superior in the posttest 1 related to both concept and principle learning. In posttest 2 there was no significant difference between groups in concept learning; but in principle learning the task analysis group again achieved significantly higher scores than both groups. If one considers the process of prerequisiste learning in task analysis (Gagne & Briggs, 1974), the subjects in this study would have needed to possess an appropriate understanding of concept learning before they could go up the learning hierarchy to principle learning. Therefore, one would have expected the task analysis group to be superior in concept learning as well as principle learning on the delayed posttest.

However, the task analysis group did perform significantly better than the advance organizer group in three out of four tests. An analysis of the instructional programs shows that the entire content of the task analysis program is contained in the advance organizer slide/ tape program. The advance organizer contained an additional number of meaningful synthesis statements at the beginning and a number of summary statements at the end of the program. The results indicate that subjects exposed to the most concise instructional program achieved the highest. It may therefore be suggested that the concepts and principle in the instructional treatment are not as complicated as previously anticipated. Instead the concepts and principle may be concrete enough to allow easy understanding through use of a brief simple program instead of the longer programs of advance organizer and concept elaboration.

Although these findings support a superiority of task analysis, it need also be recognized that all of these results are in contradiction with the pilot study results, the advance organizer literature (Ausubel, 1974), the concept elaboration literature (Reigeluth, 1983) and learning hierarchy literature in task analysis (Gagne & Briggs, 1974).

Advance Organizer and Concept Elaboration

Two models which incorporate task analysis are advance organizer (Gagne & Briggs, 1974) and concept elaboration (Reigeluth, 1983). Since both of these models in the study took the sequence characteristic of task analysis and added on the elements of synthesis and summary, these programs were both longer and more comprehensive than the task analysis program. If one accepts the suggestion that the concepts and principle are not as complicated as previously anticipated, then the longer programs of advance organizer and concept elaboration may have produced boredom and fatigue in the subjects; or at least did not contribute any additional factors. This problem of unequal instructional treatment time between control and experimental groups has been acknowledged in the literature on advance organizer (Weil & Murphy, 1983; Wilcox, Merrill & Black, 1981). Howevever, this literature would generally correlate more instruction time with increased achievement. Therefore, this assumption correlating instructional treatment time with achievement is difficult to accept.

Both of the advance organizer and concept elaboration are recommended for use with large amounts of instruction or macrostrategies. These approaches usually require instruction to be performed in more than one session. Reigeluth and Darwazeh (1982)have indicated an effort to subsume the ability to teach microstrategies into the elaboration theory. But can a macrostrategy ever be perceived as a microstrategy; and if so, when? Reigeluth (1979) presents an example of a macrostrategy in the area of economics. He states that the principle of macroeconomics require an elaborated understanding of supply and demand and debits and credits. This may in fact be an appropriate macrostrategy for a high school student; but how difficult is this principle and concept to for adult who has never had formal instruction in economics? For the adult, who is more likely to be working at a formal operations level than a high school student, this instruction may simply be a logical process which is easy to understand. Therefore, this may be perceived as a microstrategy by an adult who can quickly comprehend this information. Results of this study then pose further questions rather than clarify reasons for apparently conflicting findings.

Age

When age was compared between the subjects in the primary study and those in the pilot study, the means of 27.35 years and 22.17 years exist respectively for each population. This

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imbalance in age is a further concern because it indicates that two substantially different age groups were represented in the pilot and primary study. Therefore, the factor of age may have contributed to the failure to reject the null hypotheses.

Because students in different courses comprised the sample of the primary study a unique population distribution emerged. The mean age for the task analysis group was 24.87 years old, the advance organizer group was 26.68 years old, and the concept elaboration group was 30.42 years old. There was a significant difference in age between the task analysis and concept elaboration groups at the .01 level. Even though an analysis of covariance was used to statistically neutralized the effect of age on the achievement results one wonders if age could have had an effect.

Piaget (1971) in his analysis of cognitive development describes the final or formal stage of development as occurring around 12-15 years of age. This level of cognitive development is characterized by the ability to reason hypothetically. It is the opinion of many educators of adults (Long, McCrary & Ackerman, 1979) that cognitive development continues into and across adulthood. Research in this area (Elkind, 1962; Watson, 1968; Papalia, 1972; Renner & Stafford, 1972) report the existance of college and graduate age individuals who are not yet functioning at a formal operations stage. McKinnon and Renner (1971) reported only 25% of a college freshman sample to be at the formal stage. Arlin (1975) reported that 31 out of 60 female college seniors studied were classified as formal thinkers. Chiapetta (1975) found only 47% of 15 K-8 female teachers to be formal thinkers. The results of these studies suggest that age effects the development of learning styles and individual competence. Therefore the older the learner, the greater his/her chance of working at a formal operations level and achieving higher on a test requiring little to no synthesis or summary information. Within the context of this study, the older the subject the higher he/she achieved using an instructional approach which perceived the information as a microstrategy.

The results of the pilot study gave valid support for the primary study to procede, but when the treatments were administered to different age levels a new patterns of responses occured. The older subjects showed greater achievement with the simplest and fastest approach, the task analysis approach; the middle mean age group showed greater achievement using the more in-depth program, the advance organizer; and the younger mean age group showed greater achievement using the other more in-depth approach of concept elaboration. It then appears that the older subjects responded better to simple well sequenced instruction; the middle age subjects responded better to a well sequenced instruction with a synthesis at the beginning ang a summary at the end; and the younger subjects responded better to a well sequenced instruction with synthesizers and summarizers interspersed throughout the entire prersentation of information.

An examination of the difference in ages between the pilot study (22.17 yrs.) and the primary study (27.35 yrs.) also suggest that the primary study subjects were composed of a combination traditional/nontraditional college audience. Many of the subjects who work in business or industry full-time and enroll in classes part-time may be more accustomed to dealing with short concise pieces of information from which to draw conclusions than traditional college age subjects. A traditional age subject, on the other hand, may be used to the more traditional teaching approaches. Knowles (1978) states that the traditional learners are conditioned to have a subject-oriented curriculum while adult learners tend to have a problem-centered orientation to learning. This is due to the adult's need to apply immediately what he learns, while the traditional learner continually postpones his application as he graduates from one program into another. This may explain in part why concept and principle learning were higher in the task analysis group for posttest 1 as well as why principle learning was higher in the task analysis group for posttest 2.

Implications for Further Research

From the conclusions of the study, a suggestion for further research is to replicate the design of this study using instructioinal topics of varying difficulty. This will help to correlate instructional strategies with easy-to-difficult concepts and principles. The outcome of this effort will aid in evaluating the effective parameters of task analysis, advance organizer and concept elaboration as instructional approaches to teaching. A second suggestion for further research is to replicate this study using the same traditional subject population as used in the pilot study and randomization techniques as described by Campbell and Stanley (1963).

The unanticipated results of this study have suggested consideration of correlating age with instructional strategies.

The nomenclature of the nontraditional learner emerged in the 1970s. The Encyclopedia of Educational Research (1969) described the standard American college student as being between 17 and 23 years of age, living on or near campus, attending classes at fixed times and determined places, and following a set curriculum of sequenced courses. Although this may still characterize the regular academic year student, the older nontraditional student has emerged on campus with a new set of needs and demands. Unfortunately much of the research in this area has related to prior experimental learning (Commission on Non-Traditional Study,

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1973), adult individualized programs (Houle, 1973; Medsker, 1975), and interdisciplinary learning programs (Veysey, 1973; Change Magazine Press, 1979). However outside of the area of higher education, the adult learner has been a subject of research for the past 30 years. The results of this study may be useful in pointing new directions for research in the relationship of age to instructional strategies. A strong recommendation follows for systematic investigation of the age factor and advance organizer and concept elaboration, as well as relationships of instructional strategies for traditional and non-traditional learning populations (i.e. non-college adult learners, college degree adult learners).

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THE EFFECTS OF PRESENTATION LATENCY AND EMBEDDED ORIENTING STRATEGIES ON LEARNING FROM COMPUTER-BASED INSTRUCTION

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Abstract

In this study, the effects of explicit versus general orienting strategies and varied access time on the learning of facts and inferences were studied. A CAI lesson focusing on fictionalized science concepts was presented. Students were randomly assigned to either a cognitive or behavioral embedded orienting strategy group, receiving CAI which used either 10 or 30 seconds of access time to branch to lesson segments. Orienting strategies were presented throughout the lesson, and addressed criterion information either explicitly or in more general, abstract terms. Upon completion of the lesson, students were administered a posttest measuring both factual and inferential learning. Results indicated that orienting strategy explicitness did not affect the learning of either facts or inferences differentially. A marginal effect was found for access time, with students performing best with 30 seconds. The results suggest that differences in orienting strategies may not be as important as sufficient time for strategy utilization.

THE EFFECTS OF PRESENTATION LATENCY AND EMBEDDED ORIENTING STRATEGIES ON LEARNING FROM COMPUTER-BASED INSTRUCTION

Each new instructional technology brings with it the potential to solve current educational problems. In many instances, the expected contributions to education never materialize. The reason for for these unfulfilled expectations is not faulty technology per se but the way new technologies are incorporated. One recent computer-based instructional technology is interactive video. Floyd defined instructional interactive video as "... any video program in which the sequence and selection of messages is determined by user's response to the material" (Floyd, 1982, p.2). During the past few years, interactive video has been the subject of increased interest and utilization for instructional applications (Hannafin, Garhart, Rieber, & Phillips, 1985). However, this growing interest is founded in very little research from which to develop guidelines. To obtain optimum results from this technology, research must be performed from which empirically based guidelines can be developed (Dwyer, 1985; Hannafin, 1985).

A current concern involves the type of video delivery system best suited to interactive video: videodisc or videotape. The videodisc is considered by some to be the most significant breakthrough in instructional technology since the invention of the printing press (Reigeluth & Garfield, 1984). Because of the ability of videodisc to access video segments randomly and at much greater speeds than videotape, it is considered by many to be superior for interactive video (Hoffos, 1983).

If speed of access were the prime consideration, videodisc would indeed be the superior technology. However, other factors must be considered. For example, there are limits to the rate at which learners can process information. Providing learners with more information than they can process effectively may inhibit learning (Travers, 1982). Delays in access time between lesson segments of a lesson may provide an opportunity for the learner to process information (cf. Chu & Schram, 1967). Delays might also be utilized to present meaningful information or instructions, such as advance organizers, to improve learning and retention (Stone, 1983).

In effect, the "access time" issue may be more a learning and processing than a technology issue. Since the principal issue in the tape vs. disc arguement pertains to access time, perhaps the study should center initially on time and processing variables in learning from any computer-based lesson (Hannafin & Hughes, 1986).

Processing of information requires sufficient time to select, encode, and integrate (Tennyson, Christensen, & Park, 1984). When individuals are provided more information than able to process, they became disorganized, to the point of being unable to process information at all (Travers, 1982). Rest times between portions of video instructions increase learning by providing information process time (Chu & Schramm, 1975). From this research, it can be concluded that processing time is often useful in improving learning.

Delayed access time between lesson segments could be utilized to present advance organizing strategies to the learner. In a meta-analysis of 112 studies, Stone (1983) found that advance organizers were associated with increased comprehension and retention of material to be learned. The use of "concrete" advance organizers have had a strong effect upon the learning and retention of specific information (Mayer, 1984). Explicit strategies aid in the learning of cued information, but inhibit the learning of uncued information.

The purpose of this study was to examine the effects on learning of presentation access latency, organizing strategies, and the combination of latency and strategy. Specifically, the effects of behavioral and cognitive organizing strategies and varied processing intervals on factual and inferential learning were studied.

Methods

Subjects

The subjects were 49 college upper-division undergraduate and graduate students enrolled in computer literacy courses. Students participated during a regularly scheduled class session and were provided extra credit for participation.

Materials

The instructional treatments were modified versions of a computer-assisted instruction (CAI) lesson which was initially developed for a previous research study (see Garhart & Hannafin, 1986). The lesson described the discovery of a fictitious element on a fictitious island, and the scientific, cultural and political ramifications of the discovery on a previously primitive society. The lesson was presented as a factual account of the discovery: students were not informed as to the fictitious nature of the lesson until the study was completed. This lesson was chosen for the following reasons: 1) the fictitious content was plausible and thus eliminated the effects of prior learning; and 2) the relative ease with which factual and inferential test items could be identified

Three orienting strategies were developed: 1) instruction with embedded behavioral orienting strategies; 2) instruction with embedded cognitive orienting strategies; and 3) instruction with prompts for the learner to use individual learning strategies.

Behavioral orienting strategy. This strategy oriented the student with prompts which were specifically related to the factual content of the lesson segment which followed. The prompts provided the learner a specific orientation to the factual material subsequently assessed. The strategy consisted of a single computer frame, directing the student to attend to two specific informational items which included subsequent lesson text. One example of this strategy is: "In the next section be sure to learn this information: When the anthropologists began arriving on Jexium Island." These factual items consisted of names of people, places, specific events, and other details presented during the following lesson segment.

Cognitive orienting strategy. This strategy oriented the student with broader, more abstract prompting to the instruction which followed. These prompts were not tied to specific facts, but were designed to provide a broader contextual orientation to the content which followed. The strategy consisted of a computer frame directing the student to consider two general concepts which were to follow in the lesson text. An example of this strategy is: "In the next section, you will be presented information about: The importance of studying cultures."

Individual orienting strategy. This strategy provided no prompts to direct student attention to lesson information. Instead, the strategy simply advised the students to pay close attention to the information which followed. An example of this strategy is: "In the next section, try your best to learn the information." As in the prior two cases, three strategy frames were given before questioning.

All treatment strategies were embedded at identical lesson locations. Each strategy was presented in two access time versions: 10 seconds and 30 seconds. The strategy remained on the screen during the access interval and the computer ignored student input during the alloted processing time.

An introductory section was included to obtain general information concerning student identification, gender, age, and study preferences. The student was also given a general orientation as to the nature and organization of the lesson as well as directions for answering the questions on the computer.

The lesson consisted of four parts. Each part consisted of 10 to 14 text frames of easy to read, double-space paragraphs. Six graphic displays which supported the thematic content of the lesson were also included at various points, but were not related to specific criterion information. The orienting strategies were embedded at three evenly spaced intervals during each of the four parts.

Each part was followed by six questions: three factual type and three inferential. The 24 embedded questions also served as posttest items. Feedback was not provided after any of the questions, either during the lesson or the posttest.

Each part of the lesson began with a banner page which was displayed for 3 seconds. The first orienting strategy frame was then displayed for either 10 or 30 seconds. This was followed by four to six frames of instruction. This sequence was repeated two additional times. The student was then presented a transition frame explaining that the lesson part had concluded and that six questions would follow. After answering these open-ended, short answer type questions, the student was presented with the next banner frame for the next lesson part. This cycle was repeated for all four lesson parts.

At the conclusion of the lesson, the student was given a transition frame explaining the posttest. The posttest presented all 24 embedded questions, but in random order. The student was continually informed of the number of questions remaining in the posttest. Additional prompts were given one-third and two-thirds through the posttest. At the end of the posttest, the students were informed of the fictitious nature of the lesson and were directed to signal the proctor that the lesson was completed.

Dependent Measures

Embedded postadjunct questions. Each of the four parts of the lesson was followed by six postadjunct questions: three factual and three inferential. These were open ended, short answer questions. Factual questions measured recall of information presented during the lesson; the inference questions assessed the accuracy of conclusions based on lesson content. Reliability was .91 for the factual scale, and .81 for the inference scale. Validity was established through test item-lesson congruence and review by four evaluators.

Posttest. The 24 item posttest was a repetition of the four groups of six embedded questions presented in a random order.

Student response time. Time required by students to answer each of the two types of questions, adjunct and posttest, was also collected and collated by scale: factual and inferential. Response time was calculated by the computer and rounded to the nearest second.

Procedures

Students were randomly assigned to one of the six treatments upon arrival to class. All students were given an instruction sheet which was summarized briefly by the proctor. Each student was assigned a microcomputer terminal and given a computer diskette in accordance with their treatment group. Participants completed the lesson and posttest at their own rate, signaling the proctor when finished. During the study, all data were collected and recorded on separate diskettes.

The study was conducted during three sessions spanning a four-day period. Students completed the study in times ranging from approximately 45 to 105 minutes. In order to avoid possible contamination between the sessions, students were briefed following their participation and urged not to discuss any portions of the lesson until completion of the study. Also, the students were randomly assigned to the treatments during each day of the study in order to randomize possible contamination effects over time.

Results and Discussion

Learning Effects

The mean percent accuracy and standard deviations for both the embedded questions and the posttest are contained in Table 1. Marginally significant effects were obtained for access time, $F(1,43)=2.92$, $p<.10$. Students provided 30 seconds of controlled access time to utilize the orienting strategy performed slightly better overall than those given 10 seconds. This effect was consistent across orienting strategy, although the magnitude of the effect was modest.

Insert Table 1 About Here

Marginal differences were also found between en-route performance on embedded questions and the corresponding items on the posttest, $F(1,43)=2.62$, $p<.10$. The direction of this effect, however, was not anticipated. Student performance on posttest items was slightly better than on the embedded questions during instruction. Since the embedded questions did not include either feedback or remediation, this effect cannot be attributed to either correction or confirmation resulting from practice. Instead, the effect was likely attributable to the cuing function served by the question. En-route questions appear to cue students to presumably important lesson information. The inclusion of a question appears to direct students to retain the information contained in the question, while permitting them to ease cognitive overload by either forgetting or attending less to non-questioned information.

Although an orienting strategy main effect was not found, an orienting strategy-by-test scale interaction was detected, $F(2,43)=4.08$, $p<.05$. This interaction, illustrated in Figure 1, was characterized by better performance for the cognitive and behavioral strategies for factual versus inferential learning, while the individual strategy was most effective for inferential versus factual learning.

Insert Figure 1 About Here

Response Time

Means and standard deviations for response times are contained in Table 2. As shown, the time required to respond declined significantly from the embedded to the posttest, $F(1,43)=96.65$, $p<.0001$. This may be due to the familiarity of students with the items contained in both embedded questions and posttest portions of the study. It is also possible that students were simply more confident of their responses during the posttest, and responded more rapidly.

Insert Table 2 About Here

Students also responded more rapidly to factual versus inferential questions, $F(1,43)=80.16$, $p<.0001$. The level of learning and processing required for the retrieval of sufficient information to permit inference could contribute to the observed differences. Vickers and Packers (1982) posited a cognitive complexity paradigm. Conclusions that involve greater evaluation of "below-surface" information integrated within existing cognitive networks require greater time to retrieve. This is likely to be the case for inferential tasks, where several pieces of learned information must be evaluated concurrently in order to form conclusions. Conversely, learning that is more explicitly defined, such as factual recall, would be correspondingly easier to recall, requiring less time to retrieve. (cf Vickers & Packers, 1982).

In addition, a test interval-by-test scale interaction was also significant, $F(1,43)=21.95$, $p<.0001$. This interaction, shown in Figure 2, was characterized by a regression toward the mean during the posttest. Inferential questions still required significantly more time to answer, but the differences in response time from embedded to posttest items was not uniform.

Insert Figure 2 About Here

General Discussion

The results suggest that within the limits of this study greater access time improve learner performance. This appears to be true regardless of the type of orienting strategy present. This is inconsistent with research by Belland, et al (in press), who suggested that reductions in allotted processing time tends to intensify effort and improve learning. Since only two processing times, 10 and 30 seconds, were studied it remains to be seen if this difference would continue beyond 30 seconds, and if so, how far.

Another implication of this study pertains to the role of embedded questions as an organizational strategy. Embedded questions seem to provide an additional cue with which to organize and retrieve both factual and inferred lesson material. This contention is supported by the decrease in response time during the posttest. Since posttest questions were identical in form to the embedded questions, students were already familiar with the style and content of the posttest. It is also possible that students gained insight to questions answered incorrectly on the embedded questions as they continued through the lesson, thus correcting mistakes made during the lesson.

The increased time necessary to answer inferential questions is not surprising. Retrieval time for questions which require higher level cognitive tasks should generally be greater than for tasks which required only a lower level cognitive task, such as factual recall (Vickers & Packers, 1982).

The surprising result found in this study was the general lack of differential effect attributable to orienting strategies. It was hypothesized that students in the cognitive orienting strategy group would generally perform better than the other two groups, especially on inferential questioning. However, this was not found in this study. An explanation for this comes from Carlson, Kincaid, Lance & Hodgson (1976), who noted that students tend to revert to their own individual strategies regardless of how they are prompted during instruction. If this is the case, orienting strategies would all assume the characteristics of a "use your own" strategy. This might account for why access time resulted in more noticeable effects.

Several directions for further research are indicated. The study of access time needs further refinement in order to expand the contention that increases in time aids learning. Also, further research is necessary to determine if a ceiling level for processing time exists, and if so, the relationship between access time limits and different cognitive tasks. Further research is also needed to study whether or not students use imposed orienting strategies, or if they simply revert to individual strategies acquired over time. It would also be of interest to study developmental influences with young subjects, since they may not be as likely to have highly refined existing cognitive strategies to rely upon.

This study has raised several questions concerning how students learn from computer-based instruction. Based on this study, we can tentatively conclude that students may profit from increases in access time to process instruction, and that the computer's potential for rapid access may need to be controlled to ensure adequate processing time. Further research should clarify the roles of orienting strategies and cognitive processing time in supporting learning.

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Table 1.

Mean Percent Accuracy and Standard Deviations for Fact and Inference Scales on Embedded Questions and Posttest.

		Cognitive Processing Strategy			
Processing Time		Behavioral	Cognitive	Own	Totals
		Embedded Questions			
Facts					
10"	Mean	70.1	68.3	64.4	67.7
	(SD)	(8.1)	(17.2)	(27.3)	(18.2)
30"	Mean	72.1	67.3	79.8	73.1
	(SD)	(17.9)	(21.3)	(10.8)	(17.3)
Totals	Mean	71.0	67.8	72.1	70.3
	(SD)	(13.2)	(18.7)	(21.6)	(17.8)
Inferences					
10"	Mean	54.5	69.3	65.9	62.9
	(SD)	(21.8)	(11.8)	(17.3)	(18.2)
30"	Mean	59.1	76.1	77.3	70.8
	(SD)	(12.9)	(11.8)	(16.8)	(15.9)
Totals	Mean	56.7	72.7	71.6	66.8
	(SD)	(17.8)	(11.9)	(17.5)	(17.4)

Table 1 (cont)

		Cognitive Processing Strategy			
Processing Time		Behavioral	Cognitive	Own	Totals
		Posttest Questions			
Facts					
10"	Mean	70.1	65.4	64.4	66.8
	(SD)	(9.8)	(16.4)	(27.3)	(18.4)
30"	Mean	74.0	71.2	83.7	76.3
	(SD)	(16.9)	(19.6)	(13.3)	(17.0)
Totals	Mean	72.0	68.3	74.0	71.4
	(SD)	(13.3)	(17.7)	(23.1)	(18.2)
Inferences					
10"	Mean	61.6	71.6	67.0	66.5
	(SD)	(23.1)	(17.1)	(21.1)	(20.3)
30"	Mean	59.1	78.4	77.3	71.6
	(SD)	(12.9)	(16.1)	(16.8)	(17.2)
Totals	Mean	60.4	75.0	72.2	69.0
	(SD)	(18.4)	(16.4)	(19.2)	(18.8)

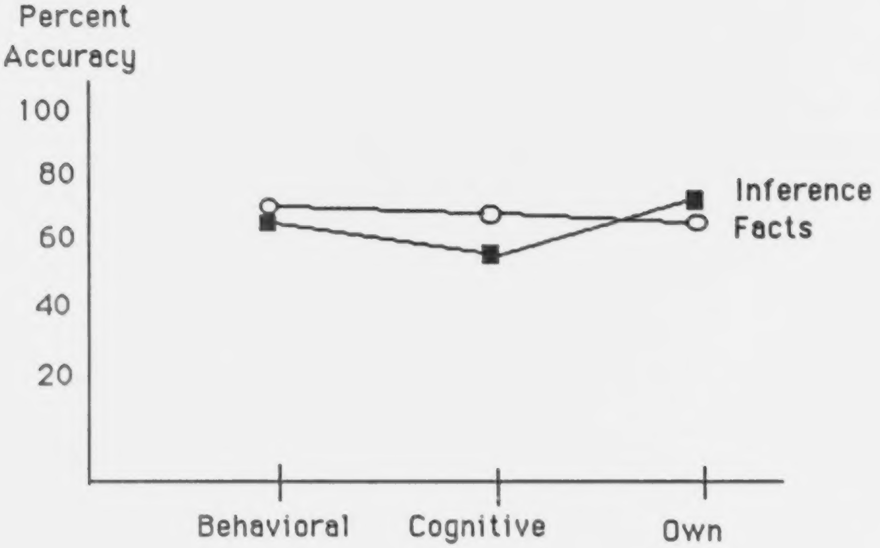
Table 2.

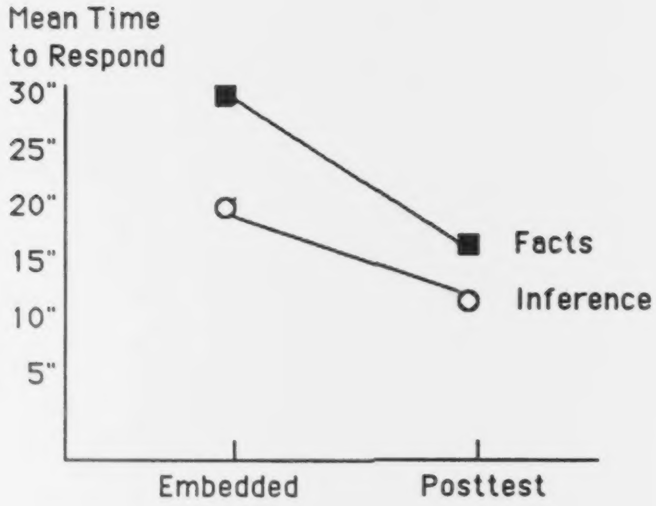
Means and Standard Deviations for Response Time Per Item for Fact and Inference Questions During Embedded Questioning and Posttest.

Processing Time		Cognitive Processing Strategy Behavioral	Cognitive	Own	Totals
		Embedded Questions			
Facts					
10"	Mean	19.7	19.2	22.6	20.4
	(SD)	(8.1)	(10.2)	(5.6)	(8.0)
30"	Mean	20.7	19.9	20.8	20.5
	(SD)	(7.2)	(7.2)	(8.2)	(7.3)
Totals	Mean	20.2	19.5	21.7	20.5
	(SD)	(7.5)	(8.6)	(6.9)	(7.6)
Inferences					
10"	Mean	25.3	28.3	33.8	29.0
	(SD)	(7.7)	(6.0)	(8.6)	(9.8)
30"	Mean	26.9	30.6	29.4	29.0
	(SD)	(14.3)	(12.8)	(15.4)	(13.7)
Totals	Mean	26.1	29.5	31.6	29.0
	(SD)	(11.0)	(9.8)	(12.3)	(11.1)

Table 2 (cont)

Processing Time		Behavioral	Cognitive	Own	Totals
		Cognitive Processing Strategy			
		Posttest Questions			
Facts					
10"	Mean	15.6	11.7	14.5	14.0
	(SD)	(6.1)	(4.5)	(2.8)	(4.8)
30"	Mean	13.7	13.9	12.9	13.5
	(SD)	(4.1)	(3.1)	(2.9)	(3.3)
Totals	Mean	14.7	12.8	13.7	13.8
	(SD)	(5.2)	(3.9)	(2.9)	(4.1)
Inferences					
10"	Mean	18.4	17.9	18.9	18.4
	(SD)	(5.5)	(2.7)	(5.2)	(4.5)
30"	Mean	18.3	18.5	17.9	18.2
	(SD)	(8.0)	(5.5)	(6.5)	(6.4)
Totals	Mean	18.3	18.2	18.4	18.3
	(SD)	(6.6)	(4.2)	(5.7)	(5.5)


Percent Accuracy
100
80
60
40
20
Inference
Facts
Behavioral
Cognitive
Own


Mean Time
to Respond
30"
25"
20"
15"
10"
5"
Facts
Inference
Embedded
Posttest

THE EFFECT OF FLUID ABILITY, VISUAL ABILITY, AND VISUAL PLACEMENT WITHIN THE SCREEN ON A SIMPLE CONCEPT TASK

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ABSTRACT

The purpose of this exploratory study was to examine the potential interactions between the media attribute, horizontal screen placement, and the cognitive aptitudes, fluid ability and visualization. Treatments included three versions of a videotaped program (left, central, or right) that were identical in every respect with the exception of ten visual stimuli. Stepwise, multiple linear regression was utilized to investigate the major hypotheses with the Group Embedded Figures Test, the Advanced Progressive Matrices Test (APM), APM subtests I and II, sex, age, and all possible interactions forming the predictor variables ($\underline{N}$=252). The resulting equation revealed a highly significant $\underline{F}$ ratio with 14 significant interactions accounting for 54 percent of the total variability. Sex and age interactions were noted. Alternative treatments promoted improved performance for many low-ability learners but actively diminished performance for many high-ability learners and vice versa. The implications of this study have affirmed the need for future research incorporating additional cognitive factors and alternate media attributes.

THE EFFECT OF FLUID ABILITY, VISUAL ABILITY, AND VISUAL PLACEMENT WITHIN THE SCREEN ON A SIMPLE CONCEPT TASK

Recent discussion has surfaced in regard to the role of confounding effects in visually-based media research. Clark (1983) has asserted media do not influence learning under any conditions, but rather the instructional method employed is the crucial factor which fosters learning. A second rival hypothesis offered by Clark is that the increased attention paid by students to media may result in increased effort or persistence which yields achievement gains. Clark's argument is based upon the small, but positive, effects of student achievement found in meta-analysis (Cohen, Ebeling, & J. Kulik, 1981; C. Kulik, J. Kulik, & Cohen, 1980; J. Kulik, Bangert, & Williams, 1983; J. Kulik, C. Kulik, & Cohen, 1979). Clark (1984a, 1984b) has continued to insist that media attributes do not influence learning in unique ways. Further, Clark and Salomon (1985, p. 474) have advanced, "Any new technology is likely to teach better than its predecessors because it generally provides better prepared instructional materials and its novelty engages learners."

In a critique of Clark's article on learning from media, Petkovich and Tennyson (1984) have noted the lack of consideration for how the operation of the various components of the human information processing system affect learning. The need for consideration of processing demands has been highlighted by research which has shown that individuals are likely to perform better in tasks in which they are suited by their cognitive style (Cronbach & Snow, 1977; Witkin, Moore, Goodenough, & Cox, 1977). Snow (1977) first postulated an intercorrelational paradigm of general ability (G) which incorporated human performance characteristics. Following the hierarchical model of ability organization interpreted by Cattell (1971) and extended by Horn (1976), Snow (1980) noted the relation of crystallized ability (G_c)--a constellation of measures of verbal knowledge, reading comprehension, and prior educational achievement--to learning outcomes is strongest in conventional instructional treatments. When such an instructional treatment is modified to reduce the need for conventional assembly and control processes, the relation of G_c to learn outcomes goes down. Fluid ability skills (G_f)--a constellation consisting of abstract and often nonverbal reasoning tests and some spatial and figural tests--should relate to learning outcomes under instructional conditions that are in some sense new, unlike those that the individual learner has faced in the past. Ability to apply previously crystallized learning skills (G_c) would not be relevant here, but ability to adapt to new kinds of learning or performance requirements (G_f) would be relevant. Snow (1980, p. 59) predicted, "...that as an instructional situation involves combinations of new technology (e.g., computerized instruction or television)...G_f should become important and G_c less important."

The distinction between "visualization" (G_v)--a constellation of figural and spatial relations tests in which the Group Embedded Figures Test (Witkin, Oltman, Raskin, & Karp, 1971) is frequently included--and G_f is often difficult to make, because they appear separable in multidimensional scaling but not in factor analysis. G_f and G_v are separable at times, with some measures, and in some populations. Often, however, the close correlation between measures from each constellation has suggested that some individuals, or all individuals, sometimes use G_f processes to perform G_v tasks. Extensive reanalyses of figural and spatial test batteries, conducted by Lohman (1979), have suggested that spatial abilities do not fit neatly into a smoothly progressive hierarchial factor model, as verbal and numerical abilities seem to do. Again it may be individual differences in the novel assembly and control of spatial processing that underlie this relation, rather than a basic relation between fluid-analytic and spatial performance processes. Therefore, G_f tests that measure to a greater degree the kinds of assembly and control processes needed to organize on a short-term basis adaptive strategies for solving novel problems should be included in studies on interaction effects on learner and media attributes. In a radex topographic model of ability test intercorrelations, Snow and Lohman (1984) have shown Raven's (1962) Progressive Matrices is in the center of the map, and is to date one of the best measures of G or G_f.

This exploratory study was conducted to investigate the potential interaction between the media attribute (Salomon, 1979), "asymmetry of the screen" (Zettl, 1973), and the cognitive aptitudes, fluid ability and visualization. Metallinos (1979) has reviewed the theoretical basis of forces operating within the television screen and has noted that, with the exception of a few experiments with inconclusive results, the investigation of left, central and right placement within the frame has been largely ignored. While some research has been reported, none has shown any cogently significant differences (e.g., Avery & Tiemens, 1975; Fletcher, 1977, 1980; Herbener, Van Tubergen, & Witlow, 1979). Using a newscast display format, Metallinos (1980) obtained significant differences for subjects describing the shape, perceiving the color, and recalling visual stimuli placed on the left side of the screen over the right; however, Niekamp (1981) reported that mean fixations of test stimuli measured by ocular photography favored the right. In regard to learning effects, Metallinos (1975) and Metallinos and Tiemens (1977) have reported no significant differences for the retention of news information. Nonetheless, Hart (1985) reported a predominant superiority for right placement on a simple concept task by older females. A meaningful difference was found for left placement over the central orientation as well, and interactions were noted. Field-independent females scored significantly higher than field-dependent females, and significant differences for and between field independence and field dependence occurred with right placement.

The purpose of this research was to ask whether, under the impact of different aptitudes, a particular frame position (left, central, or right) was warranted. The primary experimental hypothesis tested was that low-G learners who are without well developed assembly and control operations should perform more ably than high-G students who may find the visual strategies dysfunctional. Thus, the study compared a media attribute that differs in the degree to which it imposed common assemblies on students, seeking aptitude by treatment interactions in which the regression of learning on G is steeper in the treatment that is least imposing and shallower in the treatment that is the most imposing.

METHOD

Subjects

Students in a central California university enrolled in a multiple-section, "Radio-Television as Popular Culture" course were selected as subjects for the experiment. The sample consisted of 252 undergraduates ranging in age from 17 to 44 years ($\underline{M}$=22.8, $\underline{SD}$=4.0). Of the total group, 129 were male, and 123 were female. The ethnic composition was primarily Anglo American, with a representative minority of Hispanic-American, Afro-American, and Asian-American students.

Materials

Stimuli and Criterion Test. A nine-minute videotaped program and test instrument developed by Hart (1985) were employed. The program contained ten simple concepts on sex role indicators which formed the basis for a visual stimuli set and a 22-item criterion test (KR_{20}=.76). Each stimulus was constructed in three versions for left, central, and right screen placement. The three electronically edited experimental videotapes were identical with the exception of the embedded stimuli set.

Group Embedded Figures Test (GEFT). On the 18-item perceptual test (Spearman-Brown=.82), a field-independent person is able to better locate simple figures embedded in more complex designs than is a field-dependent individual (Witkin, Oltman, Raskin, & Karp, 1971). Field independence versus field dependence refers to a consistent mode of approaching the environment in analytical, as opposed to global, terms (Messick, 1977). The field-independent pole includes competence in analytical functioning, such as mathematical reasoning, verbal fluency, and spatial abilities, combined with an impersonal orientation and a tendency to have self-defined goals and reinforcements (Witkin, Moore, Oltman, Goodenough, Friedman, Owen, & Raskin, 1977). On the other hand, the field-dependent pole reflects correspondingly less competence in analytical skills combined with greater social orientation and social skills as well as the need for externally defined goals and reinforcements (Goldstein & Blackman, 1978; Witkin, Moore, Goodenough, & Cox, 1977).

Repeated age and sex differences have been noted on the GEFT. Mean scores typically tend to be slightly, but significantly, higher for males. Consequently, women, on the average, are inclined to be more field dependent than men (Witkin & Goodenough, 1981). Field dependence is also a function of age. At some point after the age of 24, the process of increasing field dependence begins (Witkin, Oltman, Raskin, & Karp, 1971). Significant decreases in GEFT scoring across'the life span have been reported with adequate reliability and validity (Panek, Barrett, Sterns, & Alexander, 1978; Panek, Funk, & Nelson, 1980).

Advanced Progressive Matrices (APM). Raven's test is a widely used set of analogical reasoning instruments which use geometric figures patterned after Spearman's wall chart (Burke, 1958). Set I consists of only 12 problems and is used to provide task training, similar to the first section of the GEFT. Set II is administered immediately thereafter and consists of 36 problems, arranged in ascending order of difficulty. Each of the 36 items consists of a stimulus array in which a 3 X 3 figural analogy is represented with a missing piece in the lower right portion of the array. A set of eight response alternatives is located beneath each stimulus array (Raven, 1962). Raven, Court, and Raven (1977) have reported a high retest reliability of 0.91. The test manual also noted a decline in scoring as age increases, particularly after the age of 30. Panek and Stoner (1980), have reported a significant decrease in performance for age groups but no significant sex differences.

Several factor analytic studies have been carried out with earlier forms of the APM. The results of these studies have prompted investigators to conclude that the tests constitute a measure of general intelligence ability or fluid G (MacArthur, 1960; Olsen & MacArthur, 1962; Spearman, 1939; Vernon, 1965a, 1965b). When the Progressive Matrices measures are factor analyzed along with other tests, the evidence is supportive of a high G loading and relatively trivial loadings on other factors. When the matrices are factor analyzed by themselves; however, evidence of multiple factors emerge (Carlson & Wiedel, 1979; Coreman & Budoff, 1974; Rimoldi, 1948; Wiedel & Carlson, 1976). Dillon, Pohlman, and Lohman (1981) found a two factor solution to yield the most interpretable structure. The two factors isolated in the factor analysis measured performance items in which a solution required (a) the addition and/or subtraction of elements or (b) the ability to perceive the progression of a pattern. The first subtest to measure the pattern progression factor was formed by combining items 2, 3, 4, 17, 26, and 36. Items 7, 9, 10, 11, 16, 21, 28, and 35 were used to form a second subtest to measure the addition/subtraction factor. These three researchers recommended subtest scores on the two factors be included in all future studies predicting behaviors.

Procedures

A total of nine randomly-assigned experimental sessions were conducted within a period of one week at the beginning of the fall semester. Each session followed the same format. As the volunteer subjects entered the room, they were encouraged by the experimenter to seat themselves in close proximity to a television receiver in order that (a) no one be farther away than 12 times the horizontal width of the screen, and (b) a line of vision of not more than 45 degrees from the center line axis perpendicular to the picture tube be maintained as a maximum viewing angle (Chapman, 1960). An initial overview of the session was provided with a short description of the instruments to be completed and of the videotaped program to be viewed. The GEFT and APM were administered, respectively, according to their test manuals (Witkin, Oltman, Raskin, & Karp, 1971; Raven, 1962). Subsequent to the completion of the cognitive indices, one of the three visual treatments was administered and immediately followed by the posttest. Subjects were not informed of the intended purpose of the experiment until a short report was presented later in the semester by the participating course instructors.

RESULTS

Group Equivalence

Because the study employed nine experimental sessions, three for each of the three treatments, equivalence of the three combined groups was an important question to investigate prior to testing for the experimental hypothesis. A three level, one-way analysis of variance was used in analyzing the data between the groups for each of the following subject background and cognitive variables: age, $\underline{F}$ (2,249) = 1.56, $\underline{M}$ = 22.8; GEFT, $\underline{F}$ (2,249) = .45, $\underline{M}$ = 11.48; APM, $\underline{F}$ (2,249) = 1.31, $\underline{M}$ = 17.13. Differences between sexual composition were analyzed using the independent samples Chi-Square Test, $\chi^2(2,\underline{N}=252) = 2.06$. The results showed no significant differences between the groups on any of the variables at the .05 level of significance.

To determine if the subjects had dissimilar life-history experiences which might have altered the equivalence of the groups, two multiple choice questions on the posttest were analyzed using the Kruskal-Wallis one-way analysis of variance for ranks. No significant differences were noted between the groups at the .05 level for subjects having read sex role material, χ^2 (2,N=252) = .91, or having had a recent encounter with a sex typing situation, χ^2 (2,N=252) = .52. The mean for both questions was between the last two responses, "over two years" and "no encounter."

Regression Analysis

Multiple regression analysis has become an increasingly popular statistical technique (Serlin & Levin, 1985). Cronbach and Snow (1977) have noted that linear regression equations are most useful in exploring aptitude-treatment-interaction designs, because the technique provides a simple method for establishing a functional relationship among variables. For example, in an experiment with several treatments (a categorical variable), aptitudes of subjects (a continuous variable) may be used to study the interaction between the variables in their effect on a dependent variable.

$$Y = a + b_1X_1 + b_2X_2 + b_3X_1X_2 \ldots$$

In this study, the parameters of the multiple linear regression equation for testing the major hypotheses were computed in a stepwise manner. The independent or predictor variables were visual placement, GEFT, APM, APM Subtest I, APM Subtest II, sex, age, and all possible interactions. Table 1 presents the intercorrelations among the main variables.

Insert Table 1 about here.

Two dummy variables were created for visual placement (K-1 levels), left placement and right placement, with membership being assigned 1 and nonmembership being assigned 0. As a nominal variable, sex was treated similarly with males being assigned 1 and females being assigned 0 (Cohen & Cohen, 1983). The dependent measure was the 22-item posttest. The Biomedical Computer Program (BMDP2R) was utilized to facilitate the analysis (Dixon, 1983).

Following the examination of residuals on the initial attempt, the relationship was found to be a nonlinear "S" shape. The linearizable curve, the logistic response function, was chosen to represent the date: $P'_i = \ln (P_i/1-P_i)$, where P was the posttest expressed as a percentage. The logistic model has been used extensively in biological work. Besides medicine and pharmacology, the logistic model has been used in learning theory, the study of consumer behavior (response to advertising) and market promotion studies (Chatterjee & Price, 1977).

Applying the weighted-least-squares (WLS) method as is required on the transformed logit variable, heteroscedastic residuals were observed on APM Subtest I and APM Subtest II. Heteroscedasticity is resolved by applying variations of WLS (Draper & Smith, 1981). Estimates of the regression coefficient were carried out using WLS with weights $W_i = 1/\sigma^2_{u_i}$. Thus, the nonconstant residual variance was accounted for by case weights associated with the variance of the logistic response function, APM Subtest I, and APM Subtest II. Table 2 presents a summary of the final regression analysis, and Table 3 presents the estimated regression coefficients.

Insert Table 2 and Table 3 about here.

The stepwise multiple regression analysis yielded 14 significant variables:

$$Y' = -1.2842 - .1243X_1 + .0046X_2 + .3187X_3 + .0145X_4 + 1.4898X_5 + .0149X_6 + .0053X_7 + .3145X_8 - .1238X_9 + .00013X_{10} - .00020X_{11} + .0052X_{12} - .0033X_{13} - .00015X_{14}$$

Y' is the predicted score; X_1 is the interaction of GEFT and sex; X_2 is the interaction of GEFT and age; X_3 is the interaction of APM subtest I and right screen placement; X_4 is the interaction of sex and age; X_5 is the interaction of sex and right screen placement; X_6 is the interaction of APM, APM subtest I, and left screen placement, X_7 is the interaction of APM, APM subtest II, and sex; X_8 is the interaction of APM subtest II, sex and right screen placement; X_9 is the interaction of sex, age, and right screen placement; X_{10} is the interaction of GEFT, APM, sex, and age; X_{11} is the interaction of GEFT, APM, APM subtest I, APM subtest II, and right screen placement; X_{12} is the interaction of GEFT, APM subtest I, APM subtest II, sex, and left screen placement; X_{13} is the interaction of APM subtest I, APM subtest II, sex, age, and left screen placement; and X_{14} is the interaction of GEFT, APM subtest I, APM subtest II, age, and left screen placement. In all, five first-order interactions, four second-order interactions, one third-order interaction, and four fourth-order interactions were entered into the equation. The resulting multiple correlation was .72 with a standard error of estimate of .40. An F-test of the multiple correlation revealed F (14,237) = 181.17 which was significant beyond the .001 level.

The method of variable coding will aid in the interpretation of the interactions. The test of a coefficient is tantamount to testing the difference between the group assigned 1 in the vector with which the coefficient is associated and the mean of the group assigned 0s in all the vectors. The tests of the coefficient are therefore relevant when one wishes to test, in turn, the differences between the means of each group assigned 1 in a given vector and that of a group assigned 0s in all vectors. Dummy coding is not restricted to situations in which there are several treatment groups and a control group. They can be used to code any categorical variable, for example, sex (Pedhazur, 1982).

Two other points are worth mentioning. First, recall that product vectors represent the interaction terms. Interaction vectors are created by multiplying the vectors representing the categorical variable by the vector for the continuous variable. When more than one continuous variable is used, the vectors representing the categorical variable are multiplied in turn by each of the vectors for the continuous variables. This process is continued until all possible combinations are produced. Second, the standard regression coefficient may be thought of as the regression coefficients that would have been obtained if the various predictor variables were equal to one another in terms of means and standard deviation. The predictor variable that has the largest standard regression coefficient, disregarding whether the coefficient is positive or negative, is the best predictor; conversely, a small standard regression coefficient indicates that the corresponding predictor variable is not contributing to successful prediction as much as the other predictor variables (Cohen & Cohen, 1983; Draper & Smith, 1981).

Applying the above, the examination of the interactions will prove most informative. Since sex was assigned by designating 1 for males and 0 for females, the X_1 variable, GEFT by sex, indicated GEFT scores for male subjects had a significantly negative impact upon the prediction equation ($p<.001$). On the other hand, the sex by age interaction, X_4, indicated older male subjects had a slightly higher predicted score ($p<.05$). The interaction of sex and right screen placement, X_5, also indicated males profited from participation in this treatment group ($p<.05$); however, the higher-order interaction of sex by age by right screen placement, X_9, indicated older male subjects were dehabilitated by participation in the very same group ($p<.001$). The second-order interaction X_9 and the first-order interaction X_1 had the two largest standard coefficients, -2.19 and -1.49, respectively. Thus, they contributed greatly to the prediction equation.

The variable sex interacted in five other conditions. The APM, APM subtest II, and sex interaction, X_7, had a small positive contribution to the prediction equation ($p<.05$). Male subjects who scored well on the APM and APM subtest II performed slightly better as a result. Sex also interacted with APM subtest II and right screen placement, X_8, indicating males with high APM subtest II scores benefited from placement in that treatment condition ($p<.01$). Variable X_{10}, the interaction of GEFT, APM, sex, and age, indicated older males who possessed high GEFT and APM scores had slightly larger predicted scores ($p<.01$). The higher-order interaction X_{12}, GEFT by APM subtest I by APM subtest II by sex by left screen placement, evidenced high scoring males on the cognitive variables profited from placement in that treatment condition ($p<.001$), but the fourth-order interaction X_{13}, APM subtest I by APM subtest II by sex by age by left screen placement, indicated older males who performed well only on the APM subtest I and APM II were dehabilitated by placement in that very same group ($p<.001$). Variables X_{12} and X_{13} had almost equal but opposite standard coefficients, .84 and -.89, respectively.

Of the five remaining interaction variables, four included treatment conditions, and one included a first-order interaction with a cognitive index. Unlike variable X_1, GEFT by sex, variable X_2, GEFT by age, revealed GEFT scores had a small positive impact upon the prediction equation when considering the subjects' age ($p<.001$). In regard to the treatment conditions, variable X_3, the APM subtest I by right screen placement interaction, indicated that subjects with high APM subtest I scores profited from participation in that treatment ($p<.001$), and the interaction also had a heavy positive impact upon the prediction equation with a standard coefficient of 1.12. On the other hand, variable X_{11} disclosed APM subtest I and right screen placement interacted at a higher level with GEFT, APM, and APM subtest II, producing a slightly dehabilitating effect in the very same treatment for high scoring subjects on all the cognitive variables ($p<.001$). When considering left screen placement, the interaction of APM, APM subtest I, and left screen placement in variable X_6 had a slightly positive effect on the prediction equation with high scoring subjects on those measures being aided by the placement condition ($p<.001$). Again, the higher-order interaction of GEFT by APM subtest I by APM subtest II by age by left screen placement, X_{14}, resulted in a slightly diminishing effect for the prediction equation ($p<.001$). Yet on the variable, those older, high scoring subjects on GEFT, APM subtest I, and APM subtest II were only slightly dehabilitated by that same treatment.

Among the 14 significant predictors, 11 contained cognitive indices in interaction terms. All the cognitive tests and subtests were represented. Nine of the variables also contained screen placement treatments. Of these, five contained right screen placement and four contained left screen placement. When considering those variables with standard coefficients of approximately one or greater which would have contributed the most to the prediction equation, right screen placement was contained in three of the four interactions: X_3, X_5, and X_9. Of the four major predictors, cognitive indices contributed only to two interactions: X_1, GEFT by sex, and X_3, APM subtest by right screen placement.

DISCUSSION

Before commencing with a discussion of the resulting data, a circumspection should be observed. In interpreting multiple-regression factors from an aptitude-interaction standpoint, third-order and higher interactions must be interpreted cautiously, if at all, without well grounded theory (Cronbach & Snow, 1977). Unreliability may have especially powerful effects in a multivariate study. Index error, sampling error, and sample size may have produced anomalies. Thus, this study should be considered exploratory in nature.

Performance on a simple concept task presented via three screen placements was found to possess a significant aptitude-treatment prediction equation, although age differences and sex differences were noted. The relationship between variables may be interpreted as substantial support for a cognitive aptitude theory of learning from instruction (Cronbach & Snow, 1977; Witkin, Moore, Goodenough, & Cox, 1977) and the media attribute theory (Salomon, 1979). This rationale is particularly warranted when considering that alternative treatments promoted improved performance for many low-G learners but actually diminished the performance of many high-G learners. In other words, the treatment that was mathemagenic (gave birth to learning) for one kind of individual appeared to be mathemathanic (give death to learning) for another kind of individual and vice versa (Snow, 1977; Snow & Lohman, 1984). To say it still another way, different kinds of inaptitudes showed through from the inner environments of low-G and high-G learners, depending on the nature of the outer environment.

Results confirmed Hart's (1985) findings of a general superiority for older females ($\underline{M}$=40.0 years) when right screen placement was utilized to facilitate simple concept learning. Older males were severly dehabilitated under the right screen treatment in the present study, despite that males, as a whole, performed better under right screen placement in the lower-order interaction. Niekamp (1981) had noted, by ocular photography, mean fixations favoring the right for a small group of subjects who were predominately males. In addition, field-independent females were at a distinct performance advantage, as they had been in the earlier Hart study, confirming that modeling cue attendance favored only the highly field-independent learners (Salomon, 1979; Witkin, Moore, Oltman, Goodenough, Friedman, Owen, & Raskin, 1977). Contrary to expectations for reported sex differences (Witkin & Goodenough, 1981), field-independent males were dehabilitated over all the visual treatments; however, the lower social orientation of field-independent males may have interacted with the sex-role subject matter to produce this effect (Goldstein & Blackmen, 1978; Witkin, Moore, Goodenough, & Cox, 1977). Older male performance was found to increase generally when fluid ability skills evidenced on the APM were called upon to direct spatial visualization abilities exhibited on the GEFT (Snow, 1980). This performance advantage partially supported the age-related differences noted on the indices (Witkin, Oltman, Raskin, & Karp, 1971; Panek, Barrett, Sterns, & Alexander, 1978; Panek, Funk, & Nelson, 1980; Panek & Stoner, 1980).

In regard to the APM and its subtests, right screen placement was found to increase simple concept acquisition for those high ability subjects who possessed increased pattern addition/pattern subtraction skills (APM subtest I). Individuals performing well on the factor are expected to successfully ferret out figures from more complex forms, to identify figures placed in the periphery of vision, and to recognize words or figures with portions erased (Dillion, Pohlman, & Lohman, 1981). When the high-ability G_f skills were combined with the first subtest, the left screen placement interacted for subject performance. Perhaps the flexible processing control of G_f directed the application of what may be considered a G_v skill in the solution of the visual task (Lohman, 1979; Snow & Lohman, 1984), since normal eye scanning patterns are initiated from the left in western cultures (see, for example, the eye scanning research reviewed by Niekamp, 1981). In other words, the solution of a visual task for concept acquisition required the intervention of higher-order skills in the left orientation, but the solution was readily apparent in the right screen orientation to those individuals who possessed increased levels of the pattern addition/pattern subtraction visualization skills.

Right screen placement was also found to increase simple concept acquisition for those high-ability males who possessed pattern progression skills (APM subtest II). Individuals exhibiting high performance levels on this factor are expected to demonstrate a high degree of success in estimating projected movement and assessed consequences, as well as in performing various mental rotations (Dillon, Pohlman, & Lohman, 1981). Where the assembly and control processing of G_f interacted with the second subtest, males were at a performance advantage, irrespective of screen placement. Apparently, the G_v skill of pattern progression was activated by right screen placement in males who possessed the ability at increased levels; however, when this same skill was called into play by the higher-order G_f function, screen position made no difference in concept attainment. In other words, those males operating at higher-order strategic processing levels were able to obtain salient cues despite the visual orientation (Snow, 1977, 1980).

When G_v skills interacted, some interesting effects were observed. Males who possessed high levels of field independence, pattern addition/pattern subtraction, and pattern progression were facilitated to concept attainment over females through the left screen orientation; however, older individuals with these same G_v skills suffered a diminishment in performance under the same placement. Note that older males with only two of the three G_v measures, pattern addition/pattern subtraction and pattern progression, were dehabilitated under the left screen orientation. Perhaps some form of perceptual pretraining has been ingrained in high-ability mature individuals who automatically activate G_v skills in search of information in center of the screen when viewing television. Tentative support for this interpretation is provided by another fourth-order interaction. When the fluid-analytic G_f skill was called upon by individuals to direct the G_v skills, a diminution in concept attainment occurred under the right screen treatment over central placement. Thus, as strategic processing was called into play, the central placement proved superior over the right orientation, indicating at least an initial preference for this position. Once again, the reader is reminded this interpretation of the high-order interactions is offered charily until a better grounded theory of cognitive aptitudes is developed.

In summary, the media attribute (Salmon, 1979), "asymmetry of the screen" (Zettl, 1973), was found to interact with the cognitive aptitudes, fluid ability and visualization, under 14 conditions on a simple concept task. Sex differences and age differences were noted. Yet visual placement helped many lower ability learners by giving them component assemblies they could not produce on their own. On the other hand, the highest aptitude students were hindered by the visual treatments because the intervention interfered with the strategies they normally used. The importance of aptitude-treatment hypotheses and methodology is thus as clear for a research on learning strategies in mediated instruction as it is for education generally (Petkovich & Tennyson, 1984). While the method, organization, and novelty of instruction are important factors (Clark, 1983, 1984a, 1984b; Clark & Salomon, 1985), a cognitive aptitude theory of learning from instruction will account for the involvement of assembly and control processes that marshal, adapt, and monitor the operation of response components assembled into a performance program for a given task (Snow & Lohman, 1984).

This exploratory study has indicated further research is warranted with media attributes when considering the impact of different learner aptitudes. Only 52 percent of the total variability of visual placement was explained by the variation in the included cognitive aptitudes. Other cognitive factors will have to be considered for a better explanation of visual placement. Further, Zettl (1973) had identified other media coding systems within the frame: main direction of horizontal and vertical orientations, attraction of symbol mass, figure-ground relationships, psychological closure, vectors or directional lines, and movement. The relationship between the processing demands of these media attributes and the processing capacity of the learner must be also investigated. Without question, this research approach places the emphasis upon the single most important element in the educational process--the human information processing system.

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TABLE 1

INTERCORRELATIONS AMONG THE MAIN VARIABLES

Variables	1	2	3	4	5	6	7
1. Posttest	–	.32	.26	–.02	.17	–.22	.16
2. GEFT		–	.12	–.08	–.09	–.10	–.06
3. APM			–	.31	.40	–.19	.07
4. APM Subtest I				–	.08	.11	–.06
5. APM Subtest II					–	.03	–.02
6. Sex						–	.21
7. Age							–

TABLE 2

SUMMARY OF REGRESSION ANALYSIS

Source of Variation	SS	df	MS	F
Regression	41.49	14	2.96	18.17***
Error	38.66	237	.16	
N = 252	$R^2 = .52$			s = .40

***p <.001

TABLE 3

ESTIMATED REGRESSION COEFFICIENTS

Variable	Coefficient	SE	Standard Coefficient	F
GEFT X Sex	-.1243	.0180	-1.49	47.87***
GEFT X Age	.0046	.0005	.88	103.11***
APM Subtest I X Right Screen Placement	.3187	.0367	1.12	75.27***
Sex X Age	.0145	.0076	.33	3.93*
Sex X Right Screen Placement	1.4898	.6750	.99	4.87*
APM X APM Subtest I X Left Screen Placement	.0149	.0029	.81	26.87***
APM X APM Subtest II X Sex	.0053	.0026	.35	4.04*
APM Subtest II X Sex X Right Screen Placement	.3145	.1140	.91	7.61**
Sex X Age X Right Screen Placement	-.1238	.0201	-2.19	38.10***
GEFT X APM X Sex X Age	.00013	.00005	.69	8.38**
GEFT X APM X APM Subtest I X APM Subtest II X Right Screen Placement	-.00020	.00003	-.78	45.39***
GEFT X APM Subtest I X APM Subtest II X Sex X Left Screen Placement	.0052	.0012	.84	20.05***
APM Subtest I X APM Subtest II X Sex X Age X Left Screen Placement	-.0033	.0006	-.89	27.61***
GEFT X APM Subtest I X APM Subtest II X Age X Left Screen Placement	-.00015	.00004	-.62	14.91***
CONSTANT	-1.2842			

$^{*}p < .05$
$^{**}p < .01$
$^{***}p < .001$

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COLLECTION MAPPING IN SCHOOL LIBRARY MEDIA CENTERS

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COLLECTION MAPPING IN SCHOOL LIBRARY MEDIA CENTERS

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Collection evaluation is a process that allows a school library media specialist to analyze the collection and its use in order to anticipate demand and shape it accordingly. This activity can help determine how the collection meets the personal and academic needs of the library users. Evaluation also demonstrates the extent to which the materials in the school media collection support the instructional goals of the curriculum (Mancall and Swisher, 1983, pp. 257-258). In an era demanding excellence and, at the same time, accountability, collection evaluation has been playing an important role in a school library media center.

For many years, collection size measure has often been the single most important way to evaluate the collection. Yet, simply measuring collection size is not sufficient enough to reflect how a collection matches the school & curriculum it is designed to serve. Nor can this measure clearly indicate the strengths, weaknesses, or balance of a collection. The collection mapping technique with its attendant quantitative and qualitative measures might be an answer to problems like these.

Introduction of Collection Mapping Technique

The collection mapping technique was first designed by Dr. David Loertscher (in press) for guaging the potential of school library media collections to support the instructional program in schools. The basic theory behind mapping a school library media collection is based on the philosophy that a collection in a school should serve the curriculum. According to Loertscher, the total collection in a school library media center should be divided into three major divisions for the purpose of collection development: (1) A basic collection designed to serve a wide variety of interests and needs. This collection provides breadth. (2) General emphasis collections which contain materials that support a whole course of instructin such as U.S. History and beginning reading. These collections provide intermediate depth in a collection. (3) Specific emphasis collections which contain materials that support units of instruction such as "Civil War" or "dinosaurs." These collections provide full depth and support as advocated by the national standards. The mechanism by which a collection is divided into the three main collection segments, evaluated and then managed has been titled collection mapping. Mapping the collections will help a library media specialist identify collection strengths which can be compared to the curriculum of the school. The library media specialist can also compare collection size in topical areas to a national sample of emphasis collections.

Purposes of the Study

The purpose of the present study was designed to field test collection mapping as a technique and to collect enough data so that individual schools could compare their collections against a national pool of school collections. The study attempted to explore the following questions: What are the characteristics of school library collections when they are mapped? What types of collections do school library media specialists build? Can the collection mapping technique be applied to a large number of schools in various geographical locations? Can a national data pool be developed which will allow school library media specialists to compare their collections with a national sample? And, finally, how do the collections in schools compare to nationally recommended lists such as Brodart´s _Elementary School Library Collection_ (1984), the H.W. Wilson´s _Junior High School Library Catalog_ (1980), and _Senior High School Library Catalog_ (1982)?

Methodology of the Study

To explore these questions, questionnaires with cover letters were sent in October 1984 to 120 library media specialists in elementary, junior high, and high schools in 11 states (Arkansas, California, Colorado, Connecticut, Florida, Georgia, Indiana, Iowa, Oklahoma, Texas, and Wisconsin). Eighty schools returned the questionnaires. Of these, 68 provided sufficient data and were judged typical enough to be included in the study. These 68 schools included 37 elementary schools, 10 junior high schools, and 21 high schools.

There were four sections in the questionnaire. In Part 1, the library media specialist was requested to provide school name and address, the grade levels in the school, and the number of students. In Part 2, the respondent provided the total number of items in each of the following segments of the collection: reference, 000, 100, 200, 300, 398.2, 400, 500, 600, 700, 800, 900, biography, fiction, story collection, easy, periodicals, and professional collection. In Part 3 and Part 4, the respondent identified general and specific emphasis areas if there were any, and indicated the total number of items in each of the areas identified. In the study, a general emphasis area was defined as a collection strength in a library media center to support courses of instruction, while a specific emphasis area supports a single unit of instruction.

A computer program written in Basic was designed by the researcher during the Summer of 1984. The program generated a collection map and a collection chart for each school (see Table 1 and 10 as examples). A sample collection map for a typical school is shown in Table 1.

Table 1 maps a collection into three segments: (1) The number of items per student in the total collection graphed horizontally at the base of the map. (2) General emphasis area collections which generally support courses of study mapped vertically on the left. In this case, animals and folklore & fairytales are charted. (3) Specific emphasis areas which generally support units of instruction mapped vertically on the right. In this collection three areas were identified: dinosaurs, frontier and pioneer life, and Indians of North America. The collection map shows the collection strengths in terms of size. For example, there are enough materials about Indians to merit a superior rating and might be recognized by other schools in the district as a source for supplementary materials.

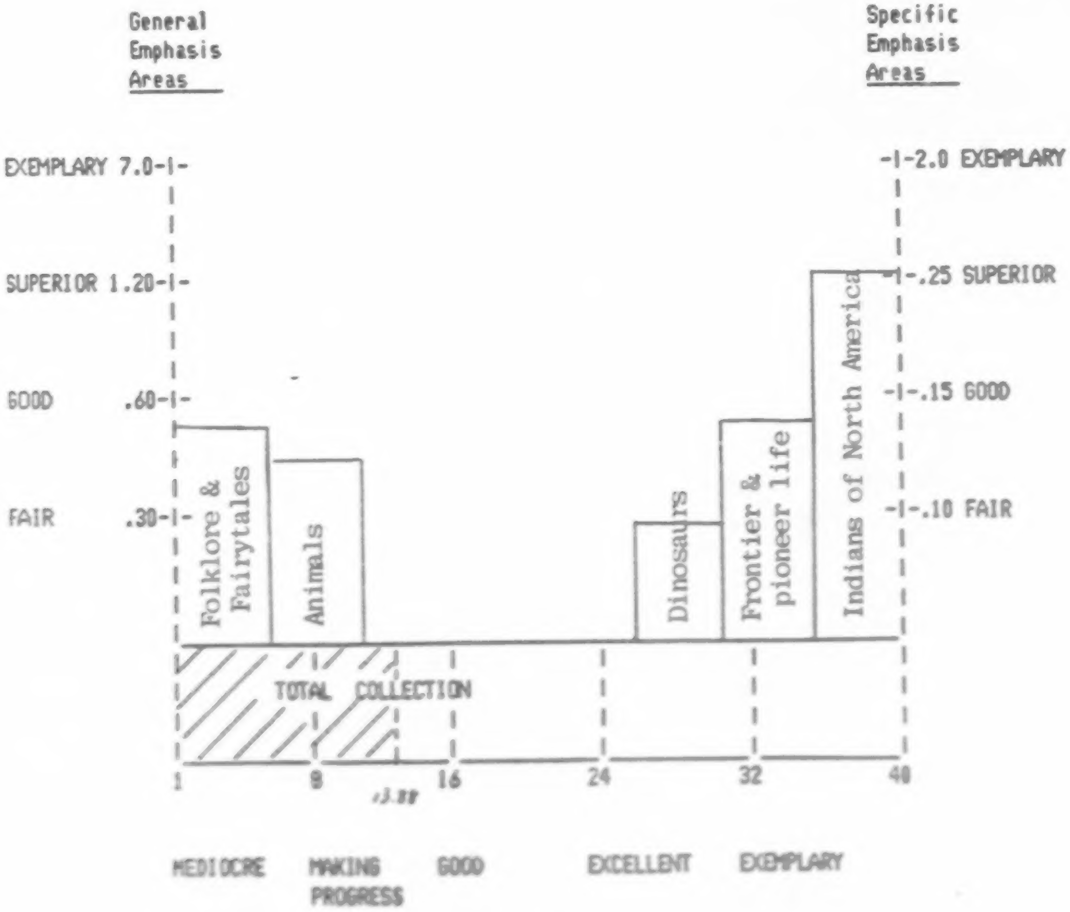
Creating the Collection Map Scales

One of the major purposes of the study was to establish the scales for the collection map segments, to give the scales reliability, and to provide a comparative picture across many schools. The national standard of 40 items per student was used as a guide to graph the total collection at the base of the map. The labels selected to denote progress in building collections were as follows: "Mediocre," "Making Progress," "Good," "Excellent," and "Exemplary." All segments of the collection were charted in items per student. Table 2 shows the five labels and the number of items desigiated for each label.

Table 1. COLLECTION MAP

School Name:
No. of Students: 597
Total Collection: 8289
No. of Total Collection Items Per Student: 13.88

	# of items	# of items per student
General Emphasis Areas:		
1. Folklore & fairytales	305	.5108
2. Animals	263	.4405
Specific Empnasis Areas:		
3. Dinosaurs	53	.0887
4. Frontier & pioneer life	79	.1323
5. Indians of North America	150	.2512



(Note: All numbers charted in items per student)

Table 2. Scale for the Total Collection Graph

Label	Items/student
Mediocre	1 - 7.9
Making progress	8 - 15.9
Good	16 - 23.9
Excellent	24 - 31.9
Exemplary	32 - 40

The creation of labels and scales for general and specific emphasis areas was more difficult since there was no standard or professional judgment in the literature to call upon for guidance. Four labels were chosen as indicative of emphasis area size: "Fair," "Good," "Superior," and "Exemplary." All of the emphasis collections in the participating schools were pooled to create the scales. Since there were two types of emphasis areas, e.g., general and specific, two pools were created. Each of the emphasis area collection sizes was divided by the number of students in each respective school and then pooled for comparison. The results revealed a tremendous difference between the largest and smallest emphasis collection sizes. Usually, a graphic scale would be divided into equidistant intervals for charting. In this case, however, such an equidistant scale proved inadequate. Therefore, the emphasis size figures were divided into four quartiles and the resulting numbers of items per student became the scale intervals. Table 3 shows the emphasis area scale intervals.

Table 3. Emphasis Collection Quartiles (Actual)

	General Areas	Specific Areas
# of areas indicated	258	204
Mean items per student	1.11	.19
Largest # of items per student	15.62	2.05
Lowest # of items per student	.01	.01
1st quartile	.27	.08
2nd quartile	.56	.14
3rd quartile	1.13	.23
4th quartile	15.62	2.05

In order to generalize the scales and make them practical for general usage, the scales were rounded as shown in Table 4.

Table 4. Rounded Emphasis Collection Quartiles

Labels	General Areas	Specific Areas
Fair	00 - .30	00 - .10
Good	.31 - .60	.11 - .15
Superior	.61 - 1.20	.16 - .25
Exemplary	1.21 - 7.00	.26 - 2.00

Note: One school in the 4th quartile had a general emphasis collection so large (15.62 items per student) that it was eliminated when the quartiles were rounded.

Findings of the study

I. Total Collection Sizes Across Schools

After collections for all the participating schools were charted and mapped, the resulting data were analyzed across the schools. As is shown in Table 5, the average collection size ranged from 8,372 in elementary schools to 18,306 in high schools.

Table 5. Average Collection Size, Average Number of Items Per Student, and Average Emphasis Area Size of the Participating Schools

Level	# of Schools	Avg. # of Students	Avg. Coll. Size	# of Items Per Student	Avg. Size of Emphasis Areas
Elementary	37	432	8372	21.16	2680
Junior High	10	891	12521	16.31	2803
High	21	1257	18306	15.79	3571

When compared with the national recommended standard of 40 items per student, the greatest number of elementary schools (14 schools) were in the range of 16 to 23.9 items per student with the rating of "Good," while most of the participating junior high and senior high schools were in the range of 8 to 15.9 items per student with the rating of "Making Progress." Table 6 reports the number of schools in each of the rating categories.

Table 6. The Number of Collections in Five Size Categories

Level	Mediocre	Making Progress	Good	Excellent	Exemplary	Total
Elementary	0	10	14	11	2	37
Junior High	0	6	2	2	0	10
High	1	12	8	0	0	21

Scale: Mediocre = 1 - 7.9 items/student
Making Progress = 8 - 15.9 items/student
Good = 16 - 23.9 items/student
Excellent = 24 - 31.9 items/student
Exemplary = 32 - 40 items/student

II. Emphasis Collections Across Schools

The collection mapping technique provided a unique way of comparing the strengths of collections across schools. Library media specialists were asked to identify emphasis collections which were defined as "topical collection segments larger than a ´typical´ school might have." Library media specialists in the 68 schools identified 462 emphasis collections. After eliminating duplication and standardizing terminology, there were 134 discrete emphasis collections identified. Collections related to social science, science, reading and literature predominated. Table 7 itemizes the emphasis areas identified in the study.

Table 7. Emphasis Collections Reported in Participating Schools

Area Name	Frequency	Area Name	Frequency
1. SOCIAL SCIENCE	134	2. SCIENCE	112
U. S. history (general)	20	Animals	44
States	17	Astronomy	11
Indians of North America	14	Science (general)	8
World War I & II	8	Computers	6
Countries	7	Earth science	6
Blacks	6	Biology	5
Holidays	6	Physical science	4
Civil War	5	Insects	3
Geography/travel	5	Mathematics	3
Presidents	4	Medical science	3
World history	4	Plants	3
American government	3	Zoology	3
Economics	3	Botany	2
North America	3	Diseases	2
Middle ages	2	Geology	2
Political science	2	Anthropology	1
Revolutionary War	2	Archeology	1
Social science (general)	2	Construction	1
U.S. history-20th century	2	Horticulture	1
Colonial America	1	Industry	1
Congress	1	Invention & inventors	1
Crime & criminals	1	Natural history	1
Death education	1		
Explorers	1	3. READING	85
Frontiers & pioneers	1		
Pioneer days	1	Folklore & fairytales	22
Political election	1	Picture books	10
Renaissance History	1	Beginning reading	9
Social interaction	1	Biography	9
Social problems	1	Fiction	9
Sociology	1	High/low reading	6
Theodore Roosevelt	1	Children's authors	5
Travel	1	Award winning books	4
U.S. geography	1	Jokes & riddles	2
U.S. foreign policy	1	Mystery & detective stories	2
U.S. history-1856-	1	Science fiction	2
U.S. history (The West)	1	Animal stories	1
Women	1	Historical Fiction	1
		Language arts-junior great bks	1
		Scientific biographies	1
		Young adult authors	1

Table 7. Cont.

Area Name	Frequency
4. LITERATURE	41
Poetry	12
Mythology	6
Shakespeare	6
American literature	5
Drama	4
American poetry	2
American authors	1
American plays	1
Authorship	1
English literature	1
Short stories	1
Theater	1
5. ART	20
Art	5
Music	4
Crafts	2
Drawing	2
ART-Western	1
Cartoons	1
Colors	1
Costume	1
Handicraft	1
Painters & painting	1
Puppets	1
6. HEALTH	13
General health	4
Nutrition	3
Drugs	2
Alcohol	1
Fitness	1
Personal growth	1
Sexuality	1
7. LANGUAGE	12
English language	3
Dictionaries	2
Foreign languages	2
German	1
Grammar	1
Latin	1
Linguistics	1
Sign language	1
8. SPORTS	12
Sports	7
Games	3
Ball games	1
Recreation	1
9. VOCATIONAL EDUCATION	10
Agriculture	1
Careers	9
10. HOME ECONOMICS	7
Cookbooks	4
Food	2
Home economics	1
11. PROFESSIONAL COLLECTION	5
Prof. coll. (general)	4
Teacher aids	1
12. PSYCHOLOGY	5
Exceptional children	2
Applied psychology	1
Child development	1
Para-psych. & psych.	1
13. REFERENCE	2
Reference (general)	2
14. LANGUAGE ARTS	1
Creative writing	1
15. RELIGION	1
Religion (general)	1
16. OTHERS	1
Controversial knowledge	1

Table 7 is instructive because it reflects the diverse curriculum areas included in the schools. High frequency of collections in topics such as U.S. history, states, Indians of North America, animals, folklore & fairy tales, picture books, poetry, and astronomy indicates that those are the most common curriculum areas in the country which are well supported by library media resources. Those areas might also be the collection targets that current library media specialists tend to build constantly. A comparison of topics missing on the list but included in a school's curriculum would indicate neglect in the collection building policy. In this case, the library media specialist might make an analysis of the reasons for collection overlap and collection neglect. Topics which are unique in one of the 68 collections give an idea of collection breadth. Schools that have large collections of Renaissance history, costume, horticulture, etc. are important in resource sharing networks. These are the collections which could be shared effectively among the schools in a network. Resource sharing is advantageous among schools if collections are diverse. To summarize Table 7, the emphasis areas were combined further into 15 central curricular subjects and ranked. Table 8 gives these rankings.

Table 8. Number of Emphasis Areas Grouped According to Curriculum Topics

Curriculum Topics	Total # of Areas Mentioned	# of Discrete Areas
Social Sci.	134	38
Science	112	22
Reading	85	16
Literature	41	13
Art	20	11
Health	13	7
Language	12	9
Sports	12	4
Voed.	10	2
Home Ec.	7	3
Prof. Coll.	5	4
Psychology.	5	2
Reference	2	1
Lang. arts	1	1
Religion	1	1
Others	1	1
Total	462	134

An analysis of Table 8 reveals that emphasis areas dominate in social studies, science, and collections dealing with reading and literature. These are the curriculum areas which will be served best by the "typical" school library media collection.

III. Library Media Collection and National Selection Lists

In this study, the collections of the 68 participating schools were compared with the nationally recognized selection lists: Elementary School Library Collection, Junior High School Library Catalog, and Senior High School Library Catalog. The current editions of the recommended lists contain titles which are considered representative in many topical areas, but some areas predominate. Table 9 lists the percentages of materials in each of the Dewey Decimal classes.

Table 9. Recommended List Percentages

Dewey Area	Elementary	Junior High	High
Ref.	1.82	3.00	3.00
000	0.82	1.59	1.32
100	1.08	1.82	1.81
200	1.08	1.10	1.71
300	5.09	10.63	13.74
398.2	6.11	0.00	0.00
400	0.80	1.40	1.87
500	10.29	11.55	4.60
600	6.70	9.73	7.15
700	6.31	13.65	7.93
800	2.50	1.84	13.85
900	5.45	13.45	15.89
B	3.47	10.12	12.60
Fic	23.52	15.27	9.42
SC	1.13	2.35	2.61
Easy	15.87	0.00	0.00
Period.	1.64	0.50	0.50
Prof.	6.32	2.00	2.00
Total	100.00	100.00	100.00

Interpretation: 1.82% of the titles included in the elementary list are reference materials.

Note: None of the Wilson lists have a separate reference or professional collection. The researchers had to estimate the size of these collections through careful analysis of each Dewey section.

In a practical sense, Table 9 suggests that a library media specialist might use the national list percentages as purchasing guidelines. A number of specialists have had such purchasing targets, but such a practice has dubious value. It is, however, helpful to compare a school's collection against the standard list as a preliminary step in collection mapping. The library media specialist who is new to a collection might create a chart like Table 10 to assist in the identification of emphasis collections. The library media specialist examining Table 10 would examine the Reference section, 500's, 900's, Biography, and Easy sections first in order to identify emphasis collections. The total collection chart, however, would not help identify emphasis collections which would span several Dewey classes.

Table 10 Total Collection Chart

School Name:

No. of Students: 597

Total Collection: 8289

No. of Total Collection Items Per Student: 13.88

Dewey Area	Recommended List %	Should Have	Actually Have	Discrepancy	Likely Emphasis Area	Areas That May Need Purchase
Ref.	1.82 %	151	259	108	*	
000	0.82 %	68	86	18		
100	1.08 %	90	39	-51		
200	1.08 %	90	56	-34		
300	5.09 %	422	407	-15		
398.2	6.11 %	506	305	-201		*
400	0.8 %	66	110	44		
500	10.29 %	853	1112	259	*	
600	6.7 %	555	499	-56		
700	6.31 %	523	516	-7		
800	2.5 %	207	247	40		
900	5.45 %	452	981	529	*	
B	3.47 %	288	496	208	*	
Fic	23.52 %	1950	1343	-607		*
SC	1.13 %	94	61	-33		
Easy	15.87 %	1315	1641	326	*	
Period.	1.64 %	136	19	-117		*
Prof.	6.32 %	524	112	-412		*

When all the schools in the study were compared to their respective national list, some interesting data were generated. Table 11 compares all the elementary collections in the study to the Elementary School Library Collection percentages.

Table 11. Distribution of Collections - Elementary Schools

Dewey Area	% in School Collections	Recommended List %	Difference in %
Ref.	1.72	1.82	-0.1
000	1.02	0.82	0.2
100	0.54	1.08	-0.54
200	0.61	1.08	-0.47
300	6.58	5.09	1.49
398.2	3.43	6.11	-2.68
400	0.73	0.8	-0.07
500	12.91	10.29	2.62
600	6.29	6.7	-0.41
700	5.84	6.31	-0.47
800	2.67	2.5	0.17
900	10.31	5.45	4.86
B	5.23	3.47	1.76
Fic	21.20	23.52	-2.32
SC	0.62	1.13	-0.51
Easy	18.22	15.87	2.35
Period.	0.28	1.64	-1.36
Prof.	1.71	6.32	-4.61
Total	99.91	100.0	

Table 11 shows that more than 62 percent of an average elementary school's library holdings were in 4 categories. These categories in ranking order were: Fiction (21.20%), Easy (18.22%), 500's (12.91%), and 900's (10.31%). When compared to the recommended list percentages, an average elementary school maintained more materials in 900's, 500's, and easy sections than the recommended list. Practically, this means that the national list is not as helpful in some areas as it might be. For example, a library media specialist who needs hundreds of easy books to assist beginning readers will find very little help in the list. The specialist would also need additional bibliographies to develop the 900's and 500's collections further.

The Brodart list contained more materials in the areas of the Professional collection, 398.2's and Fiction than the schools in the study. This means that library media specialists needing to build large collections in these areas could use the recommended list to good advantage.

Table 12 compares the collections in the junior high schools of the study with Junior High School Library Catalog.

Table 12. Distribution of Collections - Junior High Schools

Dewey Area	% in School Collections	Recommended List %	Difference in %
Ref.	6.27	3.0	3.27
000	1.05	1.59	-0.54
100	0.81	1.82	-1.01
200	0.85	1.1	-0.25
300	8.46	10.63	-2.17
400	1.28	1.4	-0.12
500	10.75	11.55	-0.8
600	7.71	9.73	-2.02
700	8.61	13.65	-5.04
800	3.82	1.84	1.98
900	14.54	13.45	1.09
B	5.60	10.12	-4.52
Fic	26.96	15.27	11.69
SC	1.52	2.35	-0.83
Period.	0.35	0.5	-0.15
Prof.	1.40	2.0	-0.60
Total	99.98	100.00	

In the junior high school collections, the top ranking categories were: Fiction (26.96%), 900's (14.54%), and 500's (10.75%). Table 12 indicates that Fiction collection in an average junior high school was significantly larger than that suggested in Junior High School Library Catalog. The reference collection was also larger. On the other hand, Junior High School Library Catalog provided many more titles in 700's, Biography, 300's, and 600's.

Table 13 compares the collections of the 21 high schools in the study to Senior High School Library Catalog.

Table 13. Distribution of Collections - High Schools

Dewey Area	% of Total Coll.	Recommended List %	Difference in %
Ref.	5.82	3.0	2.82
000	1.5	1.32	0.18
100	1.7	1.81	-0.11
200	0.97	1.71	-0.74
300	12.44	13.74	-1.3
400	1.46	1.87	-0.41
500	8.5	4.60	3.9
600	7.63	7.15	0.48
700	7.83	7.93	-0.1
800	9.88	13.85	-3.97
900	15.99	15.89	0.1
B	6.12	12.60	-6.48
Fic	17.12	9.42	7.7
SC	1.69	2.61	-0.92
Period.	0.45	0.5	-0.05
Prof.	0.89	2.0	-1.11
Total	99.99	100.00	

In the high school collections, more than one third of the collection in the average high school was devoted to two categories: Fiction and 900's. The third largest section was the 300's. The schools had significantly more materials in Fiction, 500's, and Reference, while the recommended list was stronger in Biography and 800's.

Conclusions and Recommendations

The main purposes of this study were to test the collection mapping technique and to compare collections of materials in schools with nationally published recommended lists. The research provided evidence that collection mapping is a viable and effective technique for collection analysis and collection management. It provides a different picture of a collection rather than just size figures. The mapping procedure is simple enough to be done without extensive training and the resulting graphic representation of a collection is not only a representation of collection strengths but also charts strength against a national sample of schools.

The collection mapping technique, as tested in this study, works well in schools with student populations of 500 - 1000. Schools with smaller and larger student bodies would need altered scales. Large schools should have fewer items per student needed for excellence ratings and small schools need more items per student.

The study gave added evidence of the breadth and depth of school library media collections in the country. The library media specialists identified 431 emphasis collections in the 68 schools covering 134 distinct topics. These collections provide sufficient diversity to support a network of resource sharing. The potential to share collections as evidenced in this study is one of the nation's richest untapped resources.

The 1975 national guidelines recommend a minimum of 20,000 items or 40 items per student for every school over 500 students. The guidelines also state that library media specialists in large schools may not wish to achieve the ration of 40 items per student. The schools in this study (which are typical according to national statistics) show that elementary schools have more items per student but smaller collections than secondary schools. In this study, the average collection size for elementary schools was 8,372; for junior highs, 12,521 and 18,306 for high schools. More research needs to be done to establish minimal collection sizes, not just for total collections but for collections to support units of instruction and courses of study. Perhaps size standards for curriculum blocks would be a direction to investigate.

The 1975 guidelines did not specify guidelines for building professional collections. Very few of the schools in this study had sizeable professional collections. In some districts, library media specialists noted that professional materials were held at the district level rather than the school. In others, these collections were very small or non-existent.

The second aspect of the study, the comparison of collections to nationally published lists, provided new insights into the composition of the recommended lists vs. actual collections of materials. Library media specialists generally build collections to support supplementary reading and subject oriented collections which serve social studies, literature and science. It is not surprising that school library collections and services only appeal to a part of the total curriculum and teaching staff in a school.

The study clearly pointed out that school library media specialists build different collections than national lists recommend. National lists contain emphasis collections which have developed over a period of time which need re-examination in light of current school curriculum. The orientation of national lists toward what publishers publish is as troubling as the narrow focus of the collections in schools.

If school collections are to support the total curriculum, library media specialists need to map their collections and create acquisition targets which match their curriculum--then channel their money into those areas. Publishers of national lists need to re-assess their lists regularly and adjust the scope to truly reflect the curriculum of the nation´s schools. H. W. Wilson, for example, hasn´t yet discovered that audiovisual media are as basic as books in an educational institution. Considering the current curriculums and the availability of computer technology, perhaps it is time to suggest that both H.W. Wilson and Brodart rethink the "raison d´etra" and the methodology of creating their publications. Perhaps core titles and emphasis collections could be made available on floppy disks on a subscription basis and/or on-line. Such a data base could be under continuous revision and could expand far beyond the current efforts toward core materials only. If printed books continue to go out of print as has happened in the past few years, the value of a printed list is questionable.

Perhaps the best advice to library media specialists from this research is to build collections in topical segments rather than just buying "things." Nationally published core lists may be useful in building a few basic materials in a topical area but to build strength and depth into a collection requires a different approach.

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Principals' and Teachers' Attitudes Toward Kansas School Media Libraries

by

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The intent of this research was to discover (1) the attitudes of teachers and principals toward rural school libraries, (2) how school principals and teachers compare in their attitudes and (3) what do they expect in the way of services? I made a special effort to ascertain the adequacy of microcomputer technology in Kansas rural schools.

I identified four hundred rural and small schools in Kansas and asked them to participate in this research. The schools identified are involved with the Kansas State University Center for Rural Education and Small Schools. All schools had an enrollment of less than 600 students. Of the four hundred schools in the sample, one hundred and eighty-two schools responded. I used no follow up letter and this may account for the moderate rate of questionnaries returned (45.5%).

The principals of each school received three copies of the twenty item questionnaire (see Appendix I). Each principal completed a copy and selected two teachers to fill out the other two copies. The three copies were returned by the principal. I collected and analyzed demographic data and attitudes toward school media library services and programs. I also analyzed frequencies for the demographic data and used a multivariant analysis of variance to compare principal and teacher groups. The questionnaire consisted of twenty items with the subject ranging from teachers' and students' attitudes about using the library to instructional development services. The higher the score of each item, the more positive the response of the principal or two teachers.

The principal was the contact person in this study and he or she designated the two teachers that were to respond to the questionnaire. This procedure was considered the most expedient and practical, but it should be noted that certain biases and influences affected the data found since the principal did the selecting of the two other respondents. Readers of this study should keep in mind the possible biases inherent in this procedure. A second limitation is that the attitudinal data collected does not necessarily reflect what conditions really exist in rural or small schools, but only attitudes and opinions about these conditions. The demographic data I collected did provide some description and information about budgets, volumes of library books, enrollment, staffing and education of the school media library personnel. A third limitation is the fact that there was only a moderate return of questionnaires (45.5%) from the respondents, and I can only wonder about the reasons. Follow up letters might have given a greater return percentage or phone calls to school districts might have provided more data.

Results and Discussions

I summarized the demographic data for enrollment, number of books and budget in Tables 1, 2, and 3. Over half the schools that responded to the questionnaire have enrollments between 101 and 400 students (57.7%). Only 4.9% or nine schools have over four hundred students. The number of books in the collections vary greatly.

Eleven schools had collections of 2000 or fewer books. Twenty-five percent had 6000 to 8000 books. Eleven other schools had over 10,000 books. My recommendation is a minimum of 15,000 to 20,000 books for most school media libraries to do an adequate job supporting the curriculum. For rural or small schools I recommend some kind of sharing or network system to reach the goal of a collection of 15,000 books. Rural or small school budgets varied, with twenty schools having a budget of under 1000 dollars and one school a 62,500 dollar budget. The largest number of schools (N=29) reported a budget range between 2001 and 3000 dollars.

Eighty-four percent of the schools have a certified librarian. The percentage of time a librarian spent at one site was 66.2%, meaning the librarian spent one-third of his or her time either at another school site serving another faculty or spent that time teaching or with other educational activities.

Another study from the Kansas State Department of Education showed that the number of schools served by one librarian was as follows:

In 11 districts one librarian serves 4 or more sites.
In 36 districts one librarian serves 3 sites.
In 106 districts one librarian serves 2 sites.
In 70 districts two librarians serve 1 site.
(Level, 1984)

Level (1984) said that if librarians are to provide curriculum support and instructional development in each building, the library staffing must be based on the number of teachers in each building and the number of sites served rather than on a per pupil basis, as is the current practice.

Some of the respondents (27.9%) did not know whether their librarian had a master's degree in the specialized field of library media. Twenty-seven percent reported that their school media librarian held a master's degree in that specialized area, while 44.3% reported that the librarian did not hold a master's degree in any field.

There was a significant overall difference between the principal group and the teacher group with the approximate F=2.28 (df=20,434), p<.01. The principals generally had a higher positive attitude about the school media library than did the teachers, although both groups were positive. On two specific items of the twenty item questionnaire there was also a significant difference. The first significant item asked the "library staff's attitude toward teachers" and the teachers' (N=287) mean score was 4.58, while the principals' (N=168) mean score was 4.39 with F=6.6 (df=20,434), p<.01. The teachers felt that the library staff attitude toward teachers was better than the principals did. In the other item to show significance, the question asked about the success of library instruction: the principals (mean = 3.84) felt more positively that the school media librarians were doing a good job teaching students how to use the library than did the teachers (mean = 3.41 with a significance of F=10.27 (df=20,434), p<.001).

The three items or questions that dealt with microcomputer technology generally had lower mean scores for both principal and teacher groups than did the other items on the questionnaire (see Table 4). The principals were somewhat more positive than the teachers on these three items. One item that both principal and teacher groups agreed on was that teachers did about an average job (mean = 3.33) keeping librarians abreast of trends in curriculum.

Conclusions

This research provided some demographic data on the diversity of library services, budget and staffing in the State of Kansas. There was a significant difference between the principals' attitudes toward the school media center and that of the teachers. As a group, the principals were more positive (approximate F=2.28 [df=20,434], p<.01). Overall, most principals and teachers in small or rural schools were fairly positive about their school media libraries. Both groups were less positive about the adequacy of microcomputer technology. The demographic data showed that library staffing, budgets and collection size varied widely from school to school. Many librarians were working at one site only 66.2% of the time. In order for librarians to work closely with faculty and students in planning, selecting, producing, using and evaluating instructional materials, I believe librarians need to devote full time to one site. When this practice is impractical, some sort of networking or sharing of staff between districts may be necessary to accomplish better library staffing. Positive attitudes about library and media services are encouraging. However, from responses to the questionnaire, on-site visits and interviews with teachers and librarians I believe there is room for improvement. Local production of media and instructional planning and development are services that many librarians do not have the time to do or the necessary training to accomplish. Principals, teachers and librarians need to be informed about the potential of local production in the schools. Librarians need to know not only how to organize, catalog, and administer the school media collection, but also how to make instructional materials, work with faculty and students on learning experiences, integrate resources and services into the total school program, and share learning and teaching theories, methods and research with teachers and students.

I believe that the school media library should be the fulcrum of intellectual activity and learning for students and the catalyst for innovative learning experiences. A librarian who informs teachers about the many materials and services the library has to offer can achieve these goals and elicit a positive response toward the library. I believe librarians could do more to inform patrons (students, teachers, principals, and parents). Frequently a library needs more staffing and a budget increase to bring about a truly innovative and comprehensive media library that does more than just check out books. I believe librarians should be leaders in curriculum development, instructional development, local production and computer technology. First, I recommend further research on attitudes about the school media library with an emphasis on student and teacher attitudes. Also, I recommend that librarians work toward informing principals, teachers, parents and students about the leadership role that librarians should play in curriculum development, instructional development and local production. Third, librarians themselves may need to learn through inservice, conferences, retraining seminars and formal coursework about their role in local production, curriculum development and instructional development.

Table 1

Demographic Data on Enrollment
for Rural and Small Schools

Pupil Size	Number of Schools	Cumulative Percent	Percent of Total
1 - 50	32	27.6%	17.6%
51 - 100	36	37.4%	19.8%
101 - 200	59	69.8%	32.4%
201 - 400	46	95.1%	25.3%
401 - 1615	9	100.0%	4.9%
	182		

Table 2

Number of Books in Rural and Small Schools in Kansas

Size of Book Collection	Number of Schools (N=182)	Percentage
800 - 2000	11	6.04%
2001 - 3000	17	9.30%
3001 - 4000	26	14.30%
4001 - 5000	29	15.92%
5001 - 6000	24	13.20%
6001 - 8000	46	25.30%
8001 - 10,000	18	9.90%
Over 10,001	11	6.04%
	182	100%

Table 3

Budget for School Media Libraries of Rural and Small Schools of Kansas*

Budget	Number of Schools	Percentage of Those Schools Who Reported Data
0 - 1000	20	16.20%
1001 - 2000	21	17.07%
2001 - 3000	29	23.50%
3001 - 4000	13	10.50%
4001 - 5000	14	11.38%
5001 - 6000	12	9.76%
6001 - 7000	6	4.87%
7001 - 9500	7	5.69%
62,500	1	.813%
	N=123	

*59 schools did not report this data.

Table 4

Mean Scores and Standard Deviations of Principals' (N=168) and Teachers' (N=287) Attitudes About Microcomputers in the School Media Library

Variable	Principals' Mean Score	Standard Deviation	Teachers' Mean Score	Standard Deviation
1. Knowledge of current microcomputer software for subject areas	3.46	1.64	3.40	1.91
2. Library staff encourages teachers to use microcomputer technology	3.60	1.79	3.48	2.02
3. Library staff helps students use microcomputer software	3.59	1.84	3.42	2.04

Appendix I

Attitude Survey of School Media Libraries*

School District: ______
Name of school: ______
Principal: ______
Teacher: ______
Enrollment: ______
Grades taught: ______
Total number of volumes of library books: ______
Budget: Library media budget (excluding textbooks and equipment) for the current school year: ______ (this attendance center only)
Do you have a certified librarian? ______
What is the percentage of time the librarian is assigned to this building as a librarian? ______
How many volunteers do you use in the library? ______
Does the librarian hold a master's degree in library science? ___
Institution granting degree: ______
Other degrees: ______

PLEASE RATE THE FOLLOWING ITEMS BASED ON YOUR OWN ATTITUDE TOWARD AND EXPERIENCE WITH THE LIBRARY PROGRAM:

		Not Applicable 0	Poor 1	Below Average 2	Average 3	Above Average 4	Outstanding 5
1.	Library hours and schedule						
2.	Procedures and policies for distributing materials and equipment						
3.	Logistics and facilities for selecting, locating and using print and nonprint materials in the library.						
4.	Overall administration of library and media services and programs						
5.	Librarian's involvement in curriculum development						
6.	Professional atmosphere of the library						
7.	Library instruction for students						
8.	Students' opinion of library						
9.	Teachers' opinion of library						
10.	Librarian's knowledge of the technologies of instruction						
11.	Use of microcomputers in library management and circulation of materials						
12.	Local media production services						
13.	Integration of the library program and services with the school program						
14.	Librarian's knowledge about current microcomputer software available for subject areas						
15.	Instructional development services						
16.	Librarian's commitment to professional growth and leadership roles						
17.	Librarian's ability to work with students, teachers, administrators and parents						
18.	Librarian's ability to locate, obtain, select, evaluate and disseminate instructional materials						
19.	Librarian's knowledge of learning/teaching theory, methods and research						
20.	Library's ability to provide diverse and innovative learning experiences						

This survey is being conducted under guidelines established by Kansas State University. By cooperating, you will help the survey administrators find answers to important questions; however, your participation in this survey is strictly voluntary. You should omit any questions which you feel invade your privacy or which are otherwise offensive to you. Confidentiality is guaranteed.

* Hortin, J. A. School media specialists and their roles as teachers and curriculum activists. Reading Improvement, in press.

Additional copies of this survey available from the author: Dr. John A. Hortin, College of Education, Kansas State University, Manhattan, Kansas 66506.

Reference

Level, June. Report to the Kansas Library Media Directors. Salina, Kansas, June 2, 1984.

LONGITUDINAL CURRICULUM CHANGES
IN INSTRUCTIONAL DESIGN AND
EDUCATIONAL PSYCHOLOGY DOCTORAL PROGRAMS

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INTRODUCTION

Several writers have discussed the need for more research about instructional design, and some have identified areas particularly in need of research. One general area designated as being in need of further research is the training and education of instructional designers (Durzo, Diamond, & Doughty, 1979; Silber, 1981); several specific recommendations for modifying graduate education in instructional design have been proposed. At the same time, others have proposed changes in graduate education in educational psychology. One specific proposal which has been made is the integration of coursework in instructional design into graduate programs in educational psychology (Dick, 1978; Scandura et al., 1978). Thus, it appears that the status of graduate education in both instructional design and educational psychology is in a dynamic phase; a study examining changes in graduate education in the two fields would help to clarify how the two disciplines are changing relative to each other.

The usefulness and importance of individual components of graduate education in instructional design have been discussed. For example, guided field experience for the instructional design student has been proposed to be an essential component of an instructional design curriculum (Bass & Duncan, 1981-82). Skills in self-evaluation of job performance are necessary for professionals delivering services, and the need for better training in self-evaluation skills has been discussed (Eldridge, 1982). More broadly, the general development of higher cognitive skills as exemplified by Piaget's stages of concrete operations and formal operations has been proposed as the goal of instructional design education (Silber, 1981). Thus, proposed components of an instructional design curriculum range from very specific to fairly broad and comprehensive.

Similarly, several persons have examined the role of particular components of graduate education in educational psychology. Specific content areas such as human development, learning, motivation, and research methodology and statistics are traditional components of graduate education in educational psychology (Anastasi, 1979; Sandura et al., 1978). However, other areas such as instructional design and program evaluation have been suggested as topics which should be incorporated into the educational psychology graduate curriculum (Albino, 1979; Dick, 1978; Scandura et al., 1978).

To date, however, the relationship which exists between instructional design programs and educational psychology programs at institutions which have doctoral programs in both areas has not been examined. This study was intended to clarify specific aspects of that relationship.

The primary purpose of this study was to investigate the relationships which exist between graduate education in educational psychology and instructional design. First, the study assessed the extent to which instructional design topics are being studied in doctoral programs in educational psychology; second, the study also assessed the extent to which doctoral students in instructional design, media, and technology study educational psychology topics in their curriculum at institutions which have doctoral programs in both areas. The study also determined if specific curriculum topics in the two disciplines had changed over time, using five years ago (1978-79 school year), currently (1983-84 school year), and projections for five years in the future (1988-89) as the points in time. In this fashion, it was possible to determine the extent to which the two programs interact in terms of students studying topics in the other area.

Programs which were examined in this study are educational psychology doctoral programs and instructional design doctoral programs at schools which have both programs in their graduate curriculum. With respect to educational psychology programs, graduate programs which offer the doctorate in either "educational psychology" or "general educational psychology" were included in this study (American Psychological Association, 1981). Instructional design, media, and technology programs were identified from a listing found in the Educational Media Yearbook (1983); from this point, these programs will be referred to as instructional design programs.

Two major questions about the interaction of graduate education in instructional design and educational psychology were answered by this study. First, what differences exist between educational psychology and instructional design programs in the number of doctoral students studying specific curriculum topics at each of the three points in time which were examined? Second, can any trend in directionality be noted over time; that is, has one area shifted more in the direction of the other area? Four measures of interrelationship between the two areas, curriculum topics studied by doctoral students, recent student dissertation research, faculty dissertation research, and contact between faculty in the two programs were used to answer these questions. This paper will focus on findings from curriculum topics studied and faculty contacts; other data from this study can be found elsewhere (House, 1985).

Additionally, the study provided a descriptive characterization for each type of graduate program. Information including how frequently specific curriculum topics were studied, recent student dissertation directions, faculty dissertations, and open-ended comments by responding chairpersons were used to provide a brief characterization of instructional design and educational psychology graduate programs. These findings are also summarized elsewhere (House, 1985).

The results of this study may be of interest to several groups. First, higher-level administrators such as deans of colleges of education are provided with a more clear representation of the relationship between doctoral programs in educational psychology and instructional design. Second, administrators of doctoral programs in instructional design and educational psychology can be made aware of the degree of interrelationship between the two areas, and how that relationship is changing over time. Third, persons responsible for hiring educational psychologists and/or instructional designers are provided with a more clear characterization of the types of experiences which graduates of these programs have been exposed to.

RELATED LITERATURE

Characteristics of Instructional Design Graduate Programs

Within the structure of an ideal graduate program in instructional design, several specific areas of training would be represented and graduates would have acquired the ability to exhibit certain professional competencies. Among the specific areas to be included in an ideal program would be educational technology and media, instructional psychology, instructional development, and statistics and research methodology (Patridge & Tennyson, 1978-79). Additionally, it has been proposed that graduate students take courses outside of instructional development in order to observe how other disciplines view the learning process and conduct research (Bratton, 1981). Also, considerable discussion has focused upon professional competencies which graduates of instructional development programs should be able to perform (Task Force on ID Certification, 1981). Each of these areas will be examined in more detail.

A major component of the traditional doctoral degree curriculum is research (Spurr, 1970). In their assessment of competencies which would be included in an ideal program, Patridge and Tennyson (1978-79) found that research methodology would be a highly emphasized area; however, it has been noted that graduate students in instructional design are often not adequately trained to conduct research (Reiser, 1982). Consequently, some graduate programs are starting to provide practice experiences in research in the form of research practicum courses (Reiser, 1982).

Another integral portion of an instructional development curriculum is educational media and technology. There are two generally accepted definitions for educational technology (Romiszowski, 1981). The first definition refers to educational technology as the use of hardware or equipment in the educational process while the second definition focuses on the process of the scientific development of learning experiences through a knowledge of the psychology of learning. In their study of components of graduate programs in instructional design, Patridge and Tennyson (1978-79) surveyed course offerings in media such as visuals, computers, and audio and it would appear that the authors were employing Romiszowski's (1981) first definition of educational technology. Also, in his proposals to incorporate instructional design topics into the educational psychology curriculum, Dick (1978) discusses areas such as media selection and media production, indicating that he also employs a definition of educational technology as being primarily hardware or equipment.

Instructional psychology has also been identified as a major area of preparation in an instructional design graduate program (Patridge &

Tennyson, 1978-79). Instructional psychology is the application of findings from experimental learning psychology to various instructional settings at all levels of education (Glaser, 1982). The field of learning psychology differs from instructional psychology in that the experimental study of learning is not necessarily approached with the ultimate aim of being applied to instructional practices (Bower & Hilgard, 1981); conversely, instructional psychology is conducted with the goal of improving instructional methods (Glaser).

A final consideration of graduate education in instructional design is the development of professional competencies. A set of 16 basic competencies has been proposed (Task Force on ID Certification, 1981). This particular list focuses upon professional activities and behaviors to be correctly accomplished by instructional developers. Other competencies have been proposed, including appropriate interpersonal and consulting skills (Bratton, 1979-80) and the ability to interview clients in order to quickly learn basic knowledge in unfamiliar content areas (Bratton, 1981). Thus, a variety of behavioral and interpersonal skills are expected of the professional instructional developer.

One method by which characteristics of present ID graduate programs can be evaluated is by an assessment of the content of those programs. There has been at least one study which has assessed similarities and differences between various graduate programs in instructional development (Patridge & Tennyson, 1978-79). This project surveyed nine graduate programs in instructional design, documenting program goals and characteristics, student characteristics, and faculty preparation. Similarities and differences between masters and doctoral programs were examined. Additionally, representatives of each graduate program rated the order of emphasis placed upon a variety of student competencies for their programs; similar ratings were solicited for what order the competencies would be ranked in an ideal graduate program in instructional design.

A major difference found between masters and doctoral programs was program goals. Most programs placed an emphasis on the teaching of instructional development and/or media production for masters students, while emphasizing a more traditional study of research methodology and an area of specialization in doctoral programs (Patridge & Tennyson). With respect to faculty preparation, Patridge and Tennyson found that most faculty were trained in one of three areas (instructional development, instructional psychology, and visual technology). Faculty were considerably more often trained in visuals than any other media. As well, more faculty were trained in measurement and evaluation than media (with the exception of visuals).

Patridge and Tennyson found that many of the courses taught in graduate programs in instructional development fall within five major areas: instructional psychology, measurement and evaluation, instructional development, educational technology, and management and administration. In their discussion of the redesign of the Syracuse University instructional development graduate program, Doughty and Durzo (1981) also show that many of the courses in the curriculum fall into the categories of instructional development, media, research and evaluation, and instructional psychology/learning. Additionally, they also report that field experiences such as internships and practicums are part of the curriculum. Patridge and Tennyson report that five of the nine programs surveyed in their study offered internship experiences on a credit basis for graduate students in instructional development.

Patridge and Tennyson noted a wide variation across institutions in the number of courses offered, with courses in instructional psychology and visual technology offered considerably less often than courses in instructional development. With respect to educational media, courses in visuals were most often taught, followed by computer courses second; however, there was considerable variation found across institutions in the number of courses taught in specific areas. Each program surveyed by Patridge and Tennyson also required courses outside the formal boundaries of their own program; courses in research methodology and statistics were most often found outside the instructional development graduate program. Finally, Patridge and Tennyson also found that there was a considerable disparity between the emphasis placed on research competencies and the number of research methods courses offered within the program. More courses in research methodology and statistics were required than were actually taught in instructional development graduate programs.

In another study, Silber (1982) reported findings similar to those of Patridge and Tennyson. Silber evaluated several graduate programs in instructional development which were divisible into three classifications: A) MA programs, B) residential PhD programs, and C) commuter PhD programs. It was found that MA programs placed an emphasis on practical skills for job performance such as media production, project management, and evaluation skills, findings similar to those of Patridge and Tennyson. In fact, this study found that MA programs and residential PhD programs spent the same amount of time on design courses; the extra courses in the PhD program were represented by research and theory courses. Also, Silber found a difference in emphasis between commuter and residential PhD programs; residential PhD programs emphasized more research and theory coursework, while commuter PhD programs emphasized practical design courses. Lastly, residential PhD programs spent the most time on developing research and theory competencies in fields other than instructional development (such as motivation, perception, developmental psychology, learning psychology, and cybernetics), followed by commuter PhD programs next and MA programs last. Residential PhD programs spent approximately twice the amount of time on these areas as did MA programs.

Characteristics of Educational Psychology Graduate Programs

A recent examination of various aspects of the current status of educational psychology was conducted by Scandura et al. (1978). This study detailed major problem areas and disciplinary components of educational psychology, curriculum trends in educational psychology training programs, and promising advances in educational psychology. In an effort to clarify the major applied activities in which educational psychologists conduct research, four major topics were identified by Scandura et al.; these four major areas are: A) the identification of educational goals (including needs analysis); B) analysis/determination of what must be learned (task analysis); C) delivery/designing instructional systems (designing instruction, media selection, instructional delivery); and D) readiness/evaluation of student behavior and course effectiveness (developmental stages and readiness, evaluation of instructional programs). With regard to graduate training in educational psychology, Scandura et al., suggest that there is a wide variation in the quality of training programs, although there seems to be common core areas offered; these specific areas will be discussed later. Lastly, a number of promising advances in educational psychology were discussed by Scandura et al. (1978). Areas such as cognitive information processing, particularly as it applies to education, and artificial intelligence and models of complex human performance and instruction are cited as the most promising research areas of the future for educational psychology.

On an applied level, several authors have discussed various competencies which need to be exhibited by the educational psychologist. First, graduates of educational psychology programs should be able to interact successfully with professional educators (Brenner, 1979; Maggs & White, 1982); this ability is particularly important because many research projects arise from problems encountered in educational practices in the schools (Brenner, 1979; Thompson & Lindsay, 1982). Also, because academic openings for educational psychologists are few, skills in testing, evaluation and assessment, and school psychology are beneficial (Scandura et al.).

With respect to the graduate curriculum in educational psychology, several authors have examined the major areas of training and research represented (Anastasi, 1979; Brammer, 1967; Scandura et al., 1978). In general terms, there appears to be a relative consensus as to the major components of graduate training in educational psychology. First, training in research design, statistics, and educational measurement and test development is considered to be an integral part of educational psychology (Albino, 1980; Anastasi, 1979); in fact, methodology and statistics courses are integral parts of both educational psychology and experimental psychology graduate programs (Edwards, 1981). Additionally, training in the area of applied learning is important (Brammer, 1967; Dick, 1978). More specifically, educational psychology is oriented toward the improvement of instructional methods through the utilization of psychological research (Charles, 1980). Last, training in human development is considered to be an important part of an educational psychology curriculum (Anastasi; Dick; Scandura et al.).

There have been, however, other proposals regarding the content of an educational psychology curriculum. For example, Brammer (1967) indicates that educational psychologists should be active in relating the findings of a number of disciplines, including psychology, sociology, anthropology, and educational technology to the improvement of instructional methods; at least some training in basic human sciences is necessary (Brammer, 1967). Also, some education in the basic sciences, such as genetics, is necessary for conducting research in areas such as intelligence and intelligence testing methods, and reading achievement and reading disability (Morton, 1974).

Integrating Graduate Instruction in the Two Programs

Because of the relative youth of instructional design as a discipline, individuals working as instructional designers reflect a variety of training backgrounds (Briggs, 1982). Among the more traditional disciplines in which instructional designers have been trained are psychology and educational psychology (Briggs, 1982). Because many persons who ultimately will function as instructional designers will continue to come from educational psychology programs, Dick (1978) has proposed changes for graduate education in educational psychology to further enable graduate students to acquire instructional design skills.

Dick has proposed the integration of specific courses and experiences in instructional design into the framework of the traditional educational psychology graduate curriculum. For example, students would be taught skills in needs assessment and instructional analysis, testing and evaluation, development of instructional strategies, and evaluation of entry skills and behaviors in addition to foundations of learning, human development, and statistics. Many of these topics would generally be considered to be components of a graduate program in instructional design (Doughty & Durzo, 1981). Additionally, Dick proposed that educational psychology graduate students should have internship experiences in areas such as teacher education centers, instructional development centers, or medical education programs; the incorporation of field experiences into the graduate curriculum has been proposed to be a desirable experience (Bass & Duncan, 1981-82). Thus, Dick has proposed that the training of various instructional design topics be fully integrated into the educational psychology graduate curriculum; however, he presents no data indicating the extent to which instructional design courses and field experiences are currently being taught in educational psychology programs.

Others have also proposed that instructional design should be incorporated into educational psychology programs (Anastasi, 1979). Anastasi indicates that instructional design can be considered as a component of the larger field of instructional psychology; the purpose of instructional design is to bridge the gap which exists between experimental learning psychology and curriculum development. The result of research in instructional psychology is improved educational technology, including programmed learning material, media usage, and computer-assisted instruction. In other words, Anastasi maintains that instructional design should already exist as a component of the curriculum in educational psychology while Dick feels that, because it is currently absent in many programs, instructional design should be integrated into educational psychology graduate programs.

In a discussion of the various roles performed by educational psychologists in the health sciences, Albino (1980) suggests that teaching particular skills to graduate students in educational psychology will enhance their performance in a health sciences setting. Briefly, Albino indicates that additional training for educational psychology graduate students is necessary in the areas of consultation skills, program evaluation skills, test development and research design, and applications of learning theories. It has previously been noted that much of the foundation for training in program evaluation skills is available in psychology and educational psychology programs (Perloff, Perloff & Sussna, 1976; Wortman, Cordray & Reis, 1980). With respect to applications of learning theory, Albino emphasizes that experience in instructional design should be acquired by the educational psychology graduate student expecting to function in a health sciences setting; the ability to evaluate course structures or content and suggest alternatives is important. Additionally, a background in designing instruction for psychomotor and affective skills is important. Additionally, a background in designing instruction for psychomotor and affective skills is important, considering the large amount of time spent by health sciences students learning clinical skills. Lastly, Albino notes that educational psychology graduate programs provide little coursework or experience in developing consultation skills. As mentioned by Bratton (1979-80; 1981), interpersonal and consultation skills are also important for successful performance as an instructional developer. Patridge and Tennyson note that many of the instructional development programs surveyed in their study placed an emphasis upon the acquisition of the ability to manage problems and interact with personnel.

METHODS

Design

Within educational research, descriptive research is an essential tool for determining the present status of a variety of educational practices. In fact, descriptive research methods are required to answer questions which deal with current educational conditions (Hopkins, 1976), and can yield extremely useful results when properly employed (Asher, 1976; Burton, 1979). One of the major types of descriptive research is the status study; status studies are intended to provide information about an existing set of conditions or practices in the educational setting (Hopkins, 1976). Because the primary objective of this project was to investigate the relationships which exist between graduate education in educational psychology and instructional design, the use of descriptive research methodology was appropriate.

Subjects

As has been previously mentioned, program administrators (chairpersons) of instructional design and technology programs at 22 institutions with doctoral programs in both areas were surveyed. surveyed. These institutions were:

Florida State University
Indiana University
Iowa State University
Michigan State University
New York University
Pennsylvania State University
Purdue University
Syracuse University
Temple University
University of Georgia
University of Iowa
University of Kentucky
University of Massachusetts
University of Michigan
University of Minnesota
University of Oklahoma
University of Oregon
University of Pittsburgh
University of Tennessee
University of Texas
University of Virginia
Wayne State University

Instrument Development

A questionnaire was used to collect data on how frequently graduate students study specific topics in both educational psychology and instructional design, and how frequently those topics were studied at three points in time: currently studied (1983-84 school year), studied five years ago (1978-79 school year), and projected to be studied five years in the future (1988-89 school year).

This list of topics was developed by examining graduate catalog course descriptions of approximately one-third of the programs which were studied in this project, as well as topical headings which appeared in instructional design and educational psychology textbooks. Individual topics were chosen over courses as the unit of measure because of the large differences often noted between course descriptions and actual course content. Approximately an equal number of topics from instructional design sources and educational psychology sources was identified.

Respondents were asked to include open-ended comments on what trends were foreseen for their programs over the next five years. Information was solicited about the contact between faculty in instructional design and educational psychology and whether or not those faculty interactions were expected to increase, decrease, or remain constant over the next five years. Finally, information was solicited regarding faculty training (year and institution of doctoral degree) and recent program graduates (name and year of degree completion).

The questionnaire was initially pilot-tested by mailing it to six departmental chairpersons, three instructional design and three educational psychology, who were not at institutions included in the study. Responses were received from three of these individuals (50%). All questionnaires were completed correctly and no major changes were made before the study was initiated.

Procedures

The questionnaire was mailed with a self-addressed post-paid return envelope to chairpersons of the instructional design programs and educational psychology programs. Approximately eight weeks after the initial mailing, non-respondents were telephoned and subsequently sent a second questionnaire. At this point, chairpersons who were on sabbatical or unavailable for other reasons were identified and the questionnaires were sent to the acting chairperson. As questionnaires were received, the data were entered into a computer file for analysis.

Data Analysis

Responses on the section of the questionnaire dealing with curriculum topics were coded using a four-point scale: none=1, some=2, most=3, all=4. Means were then calculated for each topic at each point in time studied. Educational psychology programs were compared with instructional design programs on the extent to which students studied various topics at three points in time. The comparisons were made using t-tests for each topic at each of the three points in time.

In order to objectively categorize topics as either instructional design or educational psychology topics, factor analysis was used. Factor analysis is a statistical technique which allows the experimenter to examine underlying dimensions for a particular data set (Kim & Mueller, 1978). One major use of factor analysis is confirmatory; a smaller number of factors are identified which account for the covariation in a given data set. The experimenter can specify the number of factors which will be formed. In this case, two factors were used; one factor represented instructional design topics and the second factor consisted of educational psychology topics. A varimax rotation was used to simplify the factor structure. The information derived from this procedure consists of each topic and an associated factor loading for each of the two factors. A factor loading for a variable represents the correlation between that variable and the factor (Kleinbaum & Kupper, 1978). Thus, the higher positive factor loading indicates to which factor a given topic is attributed.

Topics were assigned to one of the two factors using the above procedure. A topic was assigned to the factor for which there was a higher positive factor loading. After topics were classified as being either instructional design or educational psychology topics using the above procedure, topics which were noted to exhibit high growth were analyzed to determine if either educational psychology programs or instructional design programs showed a disproportionate number of high growth topics from the other area (using means obtained using the four-point scale described previously, curriculum topics which exhibited an increase of .50 between figures for the 1978-79 school year and projections for the 1988-89 school year). Chi-square analysis was used to test for significance.

Response Rate

Questionnaires were sent to 44 individuals; 22 chairpersons of educational psychology programs and 22 chairpersons of instructional design programs. However, the chairperson of the educational psychology program at one university indicated that, contrary to original information, there was not an instructional design program at that institution. Consequently, a final sample size of 42 was used. An overall response rate of 27/42 (64.3%) was obtained. For instructional design chairpersons, 14 of 21 (66.7%) completed questionnaires while 13 of 21 (61.9%) educational psychology chairpersons completed questionnaires. One additional questionnaire was returned by an educational psychology chairperson who indicated that he was unable to understand the directions. One instructional design chairperson did not complete the first section of the questionnaire relating to student study of various curriculum topics, but did complete the other parts of the questionnaire. Also, the chairperson of one educational psychology program responded; however, he indicated that his program was being terminated due to a lack of graduate students and he was unable to complete the first section of the questionnaire. All other returned questionnaires were usable and substantially complete.

Program Comparisons

Of the two questions investigated in this study, the first three involved program comparisons and are presented in this section. First, changes in the extent to which curriculum topics are studied in each program have changed over time were examined. Second, an examination was made of the directionality of any changes.

The first question to be addressed in this section is the extent to which curriculum topics studied in each program have changed over time. Comparisons were made between programs for each curriculum topic at each of three points in time. A number of changes were noted in the number of students studying specific topics at each of the three points in time examined. These figures are presented in Table 1. The means presented in Table 1 were obtained using the four-point scale described earlier (none-1, some-2, most-3, all-4). Of the 72 curriculum topics examined in this study, 30 (42%) showed no significant differences between educational psychology and instructional design programs at any of the three points in time examined. For the remaining 41 topics, several interesting patterns were noted. For example, achievement motivation was reported to be studied by significantly more educational psychology students than instructional design students five years ago (Table 1). Subsequently, the number of educational psychology students studying achievement motivation remained constant while a large number of instructional design students began to study the topic and eliminated any significant differences between the two groups for the current school year or five years in the future. Similarly, significantly more educational psychology students studied adolescent development five years ago and during the current school year.

However, the number of educational psychology students studying adolescent development is reported to be decreasing while the number of instructional design students studying it is increasing, producing no significant difference between the two programs for the 1988-89 school year.

Another interesting pattern was noted for computer-assisted instruction and interactive video. No differences were found between students in educational psychology and instructional design programs for the 1978-79 school year for either topic. The number of instructional design students reported to study these topics increased for the 1983-84 school year and were projected to increase more by the 1988-89 school year. The number of educational psychology students reported to study these topics also increased, although at much slower rates, producing significant differences between educational psychology and instructional design programs for the 1983-84 and the 1988-89 school years.

A similar trend was noted for program evaluation and consultation skills. Although these topics were to be more frequently studied at each point in time by instructional design students, no significant difference was found between programs for either topic during the 1978-79 school year. However, significantly more instructional design students were reported to take each topic during both the 1978-79 school year and projected for the 1988-89 school year.

Many topics studied by significantly larger numbers of instructional design students at each of the three points in time were related to media production: audio/slide production, graphics production, media center administration, media selection and use, photography production, telecommunications, transparency production, and videotape/TV production. A second set of topics which were studied by significantly more instructional design students was related to instructional delivery and evaluation. These topics include curriculum development, design of instruction, formative evaluation, individualized instruction, instructional evaluation, instructional objectives, instructional strategies, needs assessment, sequencing instruction, summative evaluation, systems concepts, task/content analysis, and teaching methods.

In contrast, relatively few topics were studied by significantly more educational psychology students at each point in time. These topics were generally related to human development: language development, self-concept determinants, and sex role development.

In addition to the differences between educational psychology and instructional design programs discussed above, a number of similarities were also found. Referring again to Table 1, it can be seen that one of the major similarities found between the two programs was the number of students studying statistics and measurement topics. For example, chairpersons of both programs indicated that a substantial number of students currently studied analysis of variance/covariance, correlation, descriptive statistics, inferential statistics, standardized tests, and test reliability/validity. Similarly, research topics such as experimental research methodology and research design were indicated to be frequently studied by students in both programs. Topics which were indicated to be studied less often but at approximately equal levels by students in each program included factor analysis, naturalistic research methodology, nonparametric statistics, criterion-referenced testing, norm-referenced testing, and standardized tests. The only statistics topic for which a large difference between the two programs was found was multiple regression; significantly more educational psychology students study it than do instructional design students. Additionally, the respondents indicated that this difference would grow even larger in the future. Educational psychology chairpersons indicated that more of their students would study multiple regression in the future while instructional design chairpersons felt that the same number of their students would study this topic in the future. Finally, a measurement topic, latent trait theory, was studied by relatively few students in either program.

A second question addressed in this study was the issue of directionality of change. In order to determine whether instructional design is incorporating components of the educational psychology curriculum or if educational psychology is incorporating components of the instructional design curriculum, several factors were examined. These factors include curriculum topics, student dissertation research, faculty dissertation research, and contact between faculty in the two disciplines.

Considering curriculum topics, it will be recalled that one of the methods used to characterize instructional design and educational psychology programs was factor analysis. Two factors were used in the factor analysis procedure. It will be recalled that topics were assigned to one of the two disciplines on the basis of the factor analysis procedure; curriculum topics were assigned to the factor for which they exhibited the highest positive factor loading. In general, computer assignment of the topics placed them in the factors as was expected. Each topic was then examined in order to note whether or not a disproportionate number of "instructional design" topics were exhibiting growth in educational psychology programs. Similarly, "educational psychology" topics were examined as to whether or not they were exhibiting growth in instructional design programs.

"High growth" was defined as a gain of .50 or more for the mean score between the 1978-79 school year and projected figures for the 1988-89 school year (using the four-point scale previously described and presented in Table 1). Using this criteria for growth, 33% of the high growth topics in instructional design programs were topics which had been classified as "educational psychology" topics by the factor analysis procedure. In contrast, 75% of the high growth topics in educational psychology programs were "instructional design" topics, this being a significant difference (chi-squares=5.00, df=1, p<.05). When the criteria for defining a high growth topic was changed to a gain of .70 or more for the mean score between the 1978-79 school year and projected figures for the 1988-89 school year, 25% of the high growth topics in instructional design programs were "educational psychology" topics; 75% were "instructional design" topics (chi-square-3.20, df-1, p<.08). Although overall significance was lost (probably due to smaller sample sizes due to more stringent inclusion criteria), the general trend of educational psychology programs showing a large proportion of high growth topics which are "instructional design" topics remained consistent.

A second measure of the extent to which educational psychology and instructional design programs may be merging was the type of contact which occurs between faculty in the two programs. The extent of faculty contacts at institutions where chairpersons in both programs responded (N-9) is presented in Table 3. The most frequent activities reported by the chairpersons which involve contact between faculty in the two programs were dissertation committees and faculty committees. Activities which involve little contact include team-teaching courses, joint program administration, and collaborative research and publication. Finally, all chairpersons indicated that these interactions have either increased or remained constant over the past five years. The respondents were evenly divided, however, as to whether or not they anticipate those faculty interactions will increase over the next five years.

These findings suggest that the two disciplines are indeed moving closer to one another, with educational psychology programs incorporating more topics from instructional design programs.

Despite the finding that topics from the instructional design curriculum are being introduced into educational psychology programs, the results of this study suggest that a merging of the two areas has not occurred on the level of research activity. Student dissertation research was found to be conducted in areas specific to each discipline.

The same trend was true for cooperative faculty research. Chairpersons of both programs indicated that relatively few faculty engage in collaborative research or publishing with faculty from the other discipline.

With respect to other measures of contact between faculty in the two programs, high levels of joint faculty participation on dissertation committees and comprehensive exam committees suggests cooperation between the two disciplines. Additionally, all of the respondents felt that contact between faculty in these two areas had increased or remained constant over the past five years. There was no clear trend, however, as to whether or not those faculty interactions would continue to increase over the next five years.

DISCUSSION

The primary purpose of this study was to investigate the relationships which exist between graduate education in educational psychology and instructional design. The study assessed the extent to which instructional design topics were studied in educational psychology doctoral programs; this study also assessed the extent to which doctoral students in educational technology study educational psychology topics in their curriculum at institutions which have doctoral programs in both areas. The study also determined if specific curriculum topics in the two disciplines had changed over time, using five years ago (1978-79 school year), currently (1983-84 school year), and projections for five years in the future (1988-89) as the points in time. Finally, types of interactions between faculty in the two programs were examined.

It should be pointed out that the present study has several limitations. One limitation was that the findings are not necessarily generalizable to all instructional design and educational psychology doctoral programs. Because specific types of programs which were at institutions with programs in both areas were studied, the results may not be generalizable. A second limitation of this study is that projections were used. Consequently, these figures are not as accurate as would be the case with actual observations.

Relationships Between Programs

Two of the major questions examined on this study were: first, are instructional design and educational psychology programs in transition relative to one another and, second, what are the directions of those changes. The findings of this study suggest that educational psychology and instructional design are indeed changing relative to each other. It is also evident that those changes are occurring in an uneven fashion. For example, many of the topics which were indicated to be rapidly growing in the educational psychology curriculum were instructional design topics, suggesting a merging of the disciplines. Conversely, however, relatively few of the high growth topics in instructional design graduate programs were educational psychology topics. These findings suggest that the two disciplines are indeed moving closer to one another, with educational psychology programs incorporating more topics from instructional design programs.

Despite the finding that topics from the instructional design curriculum are being introduced into educational psychology programs, the results of this study suggest that a merging of the two areas has not occurred on the level of research activity. Chairpersons of both programs indicated that relatively few faculty in either program engage in collaborative research or publication with faculty from the other discipline.

With respect to other measures of contact between faculty in the two programs, high levels of joint faculty participation on dissertation committees and comprehensive exam committees suggests cooperation between the two disciplines. Additionally, all of the respondents felt that contact between faculty in the two areas had increased or remained constant over the past five years. There was no clear trend, however, as to whether or not those faculty interactions would continue to increase over the next five years.

Because respondents provided unclear projections as to whether or not these transitions might continue, it is possible that other factors might be involved in the transition process. For example, future curriculum changes might possibly be more influenced by institutional factors rather than national trends. Thus, the two programs may continue to grow closer at some institutions while remaining quite distinct from one another at other institutions.

Future Research

One topic for future research in this area might involve determining qualitative characteristics of student contact with a given subject area. For example, the present study assessed how many students studied particular topics at some point in their coursework; no measure was made of the extent of exposure to a given topic. By obtaining data regarding the number of student contact hours in a given area, a more accurate profile of major areas of curriculum emphasis within a type of program can be derived. Consequently, a study which examines topics in greater detail would provide an assessment of the extent to which topics are studied rather than an assessment of how many students are exposed to a given topic as was the case in this study.

A second project that would provide additional information would be a study of specific topics in a graduate curriculum. Such a project could be done using methods similar to this study. Rather than sampling a large number of topics as was done in this study, a small content area could be examined. For example, rather than identifying computer-assisted instruction as one of many topics, the research could focus on CAI as the only topic to be studied. This topic could then be divided into smaller topics such as artificial intelligence, expert systems, evaluation, simulations, and games. In this fashion, it would be possible to identify programs which are providing doctoral students with exposure to the most current topics. Open-ended responses should provide insight into the reasons for program differences; in the CAI example, possible reasons might include students with better computer science backgrounds, hardware availability, or other reasons. A project of this type would allow the researcher to study trends in smaller components of specific graduate programs in a detailed manner.

Another future research project would consist of replicating this study during the 1988-89 academic year. Responses given at that time could be compared to the findings reported in this study. Open-ended responses could be requested to investigate possible reasons for the differences between projections in the current study and findings for the future follow-up study. Such a follow-up study would allow the investigator to determine whether the instructional design topics that are being integrated into the educational psychology curriculum will lead to future dissertation research in those areas. Also, it would be possible to note if collaborative research and publication by faculty in the two programs were increasing.

Another approach to examining the trends noted in this study would be to conduct a future study using the Delphi technique. Briefly, the Delphi technique is a procedure used for forecasting trends. By distributing a series of questionnaires to experts is a particular field, responses can be modified by each individual after having evaluated the responses of the group for the previous round of questionnaires (Amidon, 1977). Opinions can be reviewed throughout the process and, by the final questionnaire, concensus and minority opinions can be developed. Such a procedure might be used to allow chairpersons of instructional design and educational psychology programs to amplify on what trends they anticipate for their programs. Opinions could be developed for the future of each discipline individually as well as for future interactions between the two disciplines.

Summary

The results of this study indicate that instructional design programs and educational psychology programs are in transition. However, these changes appear to be occurring at an instructional level. Topics from each program are being introduced into course content in the other discipline. Merging at the level of dissertation research and collaborative faculty research, however, has not taken place.

There was no clear indication as to whether or not these trends would continue. Future research can determine if the two programs will continue to move toward each other and, if that is the case, in what respects they might merge.

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Table 1

Comparisons Between Groups, Instructional Design (ID) and Educational Psychology (EP), At Three Points In Time

Topic	Academic Year	ID Mean	SD	EP Mean	SD	p
Achievement Motivation	1978-79	1.89	.60	2.82	.87	.0145
	1983-84	2.30	.82	2.83	.83	NS
	1988-89	2.75	.89	2.83	.83	NS
Adolescent Development	1978-79	1.55	.69	2.91	.70	.0002
	1983-84	1.83	.94	2.67	.78	.0270
	1988-89	2.00	.94	2.58	.90	NS
Adult Development	1978-79	2.17	.83	2.27	.79	NS
	1983-84	2.54	.88	2.64	.81	NS
	1988-89	2.92	.90	2.91	.70	NS
Affective Measurement	1978-79	2.20	.42	2.18	.75	NS
	1983-84	2.80	.42	2.25	.75	NS
	1988-89	3.10	.74	2.33	.89	.0419
ANOVA/ANCOVA	1978-79	3.73	.90	3.64	.50	NS
	1983-84	3.75	.87	3.75	.45	NS
	1988-89	3.64	.92	3.75	.45	NS
Aptitude Tests	1978-79	2.60	.97	2.82	.75	NS
	1983-84	3.09	.83	2.92	.79	NS
	1988-89	3.30	.67	2.83	.94	NS
Attribution Theory	1978-79	1.88	.83	2.09	.54	NS
	1983-84	2.33	.50	2.75	.45	NS
	1988-89	2.38	.52	2.75	.62	NS
Audio/Slide Production	1978-79	3.31	.75	1.27	.47	.0001
	1983-84	3.08	.86	1.42	.51	.0001
	1988-89	3.00	1.04	1.58	.67	.0007
Classroom Management	1978-79	1.90	.57	2.36	.50	NS
	1983-84	2.00	.63	2.50	.52	NS
	1988-89	2.00	.67	2.50	.52	NS
Cognitive Development	1978-79	2.82	.75	3.36	.67	NS
	1983-84	3.09	.83	3.67	.65	NS
	1988-89	3.36	.81	3.67	.65	NS

Table 1 (Continued)

Topic	Academic Year	ID Mean	SD	EP Mean	SD	p
Computer-Assisted Instruction	1978-79	2.23	.93	1.82	.87	NS
	1983-84	3.23	.60	2.42	.79	.0079
	1988-89	3.92	.28	2.83	.83	.0002
Computer Data Analysis	1978-79	2.42	.79	2.64	.81	NS
	1983-84	3.00	.58	3.50	.52	.0333
	1988-89	3.33	.78	3.75	.45	NS
Consultation Skills	1978-79	2.33	1.15	1.82	.40	NS
	1983-84	2.92	.79	2.00	.43	.0019
	1988-89	3.25	.75	2.33	.65	.0043
Correlation	1978-79	3.60	.52	3.55	.52	NS
	1983-84	3.55	.69	3.75	.45	NS
	1988-89	3.64	.50	3.75	.45	NS
Creativity	1978-79	2.30	.95	2.27	.47	NS
	1983-84	2.27	.90	2.33	.49	NS
	1988-89	2.64	.92	2.17	.72	NS
Criterion-Referenced Testing	1978-79	3.45	.82	2.45	.69	.0057
	1983-84	3.50	.67	2.92	.79	NS
	1988-89	3.58	.67	3.08	.90	NS
Curriculum Development	1978-79	3.15	.99	2.09	.70	.0068
	1983-84	3.15	.99	2.08	.67	.0045
	1988-89	3.25	.97	2.08	.67	.0023
Descriptive Statistics	1978-79	3.55	.82	3.73	.65	NS
	1983-84	3.42	.90	3.83	.39	NS
	1988-89	3.55	.82	3.83	.39	NS
Design Of Instruction	1978-79	3.85	.38	1.91	.54	.0001
	1983-84	4.00	.00	2.25	.62	.0001
	1988-89	4.00	.00	2.25	.62	.0001
Early School Experiences	1978-79	1.73	.65	2.18	.40	NS
	1983-84	1.75	.45	2.25	.62	.0345
	1988-89	1.64	.50	2.33	.49	.0030
Experimental Research Methodology	1978-79	3.50	.67	3.82	.40	NS
	1983-84	3.75	.62	3.83	.39	NS
	1988-89	3.75	.62	3.92	.29	NS

Table 1 (Continued)

Topic	Academic Year	ID Mean	SD	EP Mean	SD	p
Exploratory	1978-79	2.50	.85	2.64	.92	NS
Data Analysis	1983-84	2.82	.87	3.00	.95	NS
	1988-89	2.90	.99	3.08	.90	NS
Factor	1978-79	2.33	1.00	2.36	.67	NS
Analysis	1983-84	2.50	.85	2.50	.80	NS
	1988-89	2.80	.92	2.67	.89	NS
Film	1978-79	2.00	.89	1.18	.40	.0153
Production	1983-84	1.83	1.03	1.33	.49	NS
	1988-89	1.82	1.17	1.25	.45	NS
Formative	1978-79	3.73	.65	2.09	.70	.0001
Evaluation	1983-84	3.67	.65	2.25	.75	.0001
	1988-89	3.73	.65	2.33	.78	.0001
Graphics	1978-79	3.00	.91	1.36	.67	.0001
Production	1983-84	2.77	1.01	1.42	.67	.0001
	1988-89	2.64	1.03	1.42	.67	.0001
Individual	1978-79	3.33	.71	2.91	.83	NS
Differences	1983-84	3.40	.70	3.08	.90	NS
	1988-89	3.44	.73	3.08	.90	NS
Individualized	1978-79	3.45	.69	2.27	.47	.0001
Instruction	1983-84	3.50	.67	2.50	.52	.0005
	1988-89	3.67	.65	2.58	.67	.0006
Inferential	1978-79	3.50	.90	3.73	.65	NS
Statistics	1983-84	3.69	.63	3.75	.62	NS
	1988-89	3.58	.67	3.75	.62	NS
Information	1978-79	2.25	.75	2.45	.69	NS
Processing	1983-84	2.83	.72	3.00	.74	NS
	1988-89	3.00	.77	3.08	.79	NS
Instructional	1978-79	3.58	.67	2.36	.81	.0007
Evaluation	1983-84	3.85	.38	2.50	.80	.0001
	1988-89	3.83	.39	2.75	.75	.0004
Instructional	1978-79	4.00	.00	2.45	.82	.0001
Objectives	1983-84	4.00	.00	2.58	.90	.0004
	1988-89	4.00	.00	2.75	.87	.0001

Table 1 (Continued)

Topic	Academic Year	ID Mean	SD	EP Mean	SD	p
Instructional Strategies	1978-79	3.64	.67	2.09	.54	.0001
	1983-84	3.83	.39	2.25	.62	.0001
	1988-89	3.91	.30	2.50	.67	.0015
Instructional Theory	1978-79	3.42	.90	2.09	.83	.0002
	1983-84	3.62	.65	2.33	.78	.0002
	1988-89	3.55	.69	2.83	.94	NS
Interactive Video	1978-79	1.25	.45	1.27	.47	NS
	1983-84	2.00	.43	1.50	.52	.0175
	1988-89	2.82	.60	2.00	.74	.0087
Intrinsic/ Extrinsic Motivation	1978-79	2.45	1.04	2.64	.81	NS
	1983-84	2.67	1.07	3.00	.60	NS
	1988-89	2.92	1.08	2.92	.67	NS
Language Development	1978-79	1.73	.90	2.45	.52	.0317
	1983-84	1.83	.83	2.58	.51	.0147
	1988-89	1.91	.83	2.58	.51	.0279
Latent Trait Theory	1978-89	1.45	.69	1.64	.67	NS
	1983-84	1.58	.67	1.92	.51	NS
	1988-89	1.64	.67	2.08	.51	NS
Media Center Administration	1978-79	2.58	.90	1.00	.00	.0001
	1983-84	2.38	.87	1.00	.00	.0001
	1988-89	2.33	.89	1.08	.29	.0004
Media Selection and Use	1978-79	3.69	.63	1.36	.50	.0001
	1983-84	3.69	.63	1.33	.49	.0001
	1988-89	3.73	.65	1.50	.52	.0001
Memory/ Forgetting	1978-79	2.92	1.08	2.91	.83	NS
	1983-84	3.17	.83	3.17	.83	NS
	1988-89	3.27	.90	3.17	.83	NS
Meta-analysis	1978-79	1.42	.51	1.91	.94	NS
	1983-84	2.17	.58	2.17	.83	NS
	1988-89	2.27	.65	2.75	.75	NS
Multiple Regression	1978-79	2.27	.90	3.00	.77	NS
	1983-84	2.58	.90	3.25	.62	.0464
	1988-89	2.55	.93	3.42	.51	.0107

Table 1 (Continued)

Topic	Academic Year	ID Mean	SD	EP Mean	SD	p
Naturalistic Research Methodology	1978-79	1.64	.50	2.36	.81	.0199
	1983-84	2.67	.78	2.42	.67	NS
	1988-89	2.91	.94	2.50	.90	NS
Needs Assessment	1978-79	2.83	1.03	2.09	.30	.0328
	1983-84	3.50	.67	2.00	.43	.0001
	1988-89	3.75	.45	2.00	.43	.0001
Nonparametric Statistics	1978-79	2.50	1.08	2.55	.82	NS
	1983-84	2.73	.90	2.83	1.03	NS
	1988-89	2.91	.94	2.92	.90	NS
Norm-Referenced Testing	1978-79	3.18	.87	2.82	.75	NS
	1983-84	3.17	.83	3.00	.85	NS
	1988-89	3.18	.87	2.92	.79	NS
Peer Relationships	1978-79	1.50	.53	2.45	.52	.0005
	1983-84	2.00	.77	2.50	.52	NS
	1988-89	2.10	.74	2.50	.52	NS
Personality Development	1978-79	1.91	.94	2.55	.52	NS
	1983-84	1.92	.90	2.67	.49	.0190
	1988-89	2.08	1.08	2.67	.49	NS
Photography Production	1978-79	2.85	.90	1.00	.00	.0001
	1983-84	2.69	.95	1.08	.29	.0001
	1988-89	2.67	1.07	1.17	.39	.0005
Principles of Learning	1978-79	3.75	.45	3.36	.81	NS
	1983-84	3.92	.29	3.58	.67	NS
	1988-89	3.91	.30	3.67	.65	NS
Problem-Solving Skills	1978-79	2.91	.94	2.55	.69	NS
	1983-84	3.18	.75	2.92	.67	NS
	1988-89	3.30	.67	2.92	.67	NS
Program Evaluation	1978-79	2.67	.98	2.09	.54	NS
	1983-84	3.08	.79	2.50	.52	.0448
	1988-89	3.36	.67	2.75	.62	.0337
Programmed Instruction	1978-79	2.75	.75	2.18	.40	.0375
	1983-84	2.83	.72	1.92	.67	.0038
	1988-89	2.55	1.04	1.92	.67	NS

Table 1 (Continued)

Topic	Academic Year	ID Mean	SD	EP Mean	SD	p
Research Design	1978-79	3.83	.39	3.55	.69	NS
	1983-84	3.92	.29	3.75	.45	NS
	1988-89	3.91	.30	3.83	.39	NS
Roles of Heredity/ Environment	1978-79	2.42	1.08	3.18	.87	NS
	1983-84	2.42	1.08	3.08	.90	NS
	1988-89	2.45	1.13	3.08	.90	NS
Self-Concept Determinants	1978-79	1.73	.65	2.45	.52	.0088
	1983-84	1.73	.65	2.50	.52	.0047
	1988-89	1.70	.67	2.50	.52	.0052
Sequencing Instruction	1978-79	3.42	.67	1.91	.30	.0001
	1983-84	3.67	.65	1.92	.29	.0001
	1988-89	3.64	.67	1.92	.29	.0001
Sex Role Development	1978-79	1.42	.51	2.55	.69	.0002
	1983-84	1.58	.51	2.75	.62	.0001
	1988-89	1.73	.65	2.92	.79	.0008
Socio-Cultural Factors	1978-79	2.18	.87	2.55	.69	NS
	1983-84	2.27	.90	2.75	.62	NS
	1988-89	2.30	.82	2.92	.79	NS
Standardized Tests	1978-79	2.92	.90	3.18	.87	NS
	1983-84	2.83	1.03	3.33	.78	NS
	1988-89	3.00	1.00	3.33	.78	NS
Summative Evaluation	1978-79	3.38	.77	2.64	.92	.0413
	1983-84	3.62	.65	2.75	.87	.0093
	1988-89	3.83	.58	2.92	.90	.0071
Systems Concepts	1978-79	3.69	.63	2.00	.63	.0001
	1983-84	3.92	.28	2.17	.39	.0001
	1988-89	4.00	.00	2.17	.58	.0001
Task/Content Analysis	1978-79	3.33	.78	1.82	.60	.0001
	1983-84	3.92	.29	2.08	.51	.0001
	1988-89	4.00	.00	2.33	.78	.0001
Teaching Methods	1978-79	2.83	.94	2.00	.77	.0310
	1983-84	3.08	.95	2.17	.83	.0187
	1988-89	3.25	.97	2.42	.79	.0306

Table 1 (Continued)

Topic	Academic Year	ID Mean	SD	EP Mean	SD	p
Tele-communications	1978-79	2.67	.78	1.09	.30	.0001
	1983-84	3.08	.49	1.42	.79	.0001
	1988-89	3.17	.58	1.75	1.06	.0005
Test Item Writing	1978-79	2.82	.87	2.73	.90	NS
	1983-84	3.15	.80	2.75	.87	NS
	1988-89	3.25	.75	2.75	.97	NS
Test Reliability/ Validity	1978-79	3.18	.87	3.64	.67	NS
	1983-84	3.42	.67	3.67	.65	NS
	1988-89	3.64	.50	3.67	.65	NS
Transparency Production	1978-79	3.15	.90	1.36	.92	.0001
	1983-84	2.92	.86	1.33	.89	.0001
	1988-89	2.75	1.06	1.42	.90	.0031
Verbal Learning	1978-79	2.67	.98	2.82	.60	NS
	1983-84	2.67	.98	2.92	.79	NS
	1988-89	2.73	1.01	2.92	.79	NS
Videotape/TV Production	1978-79	2.92	.95	1.09	.30	.0001
	1983-84	2.92	.76	1.08	.29	.0001
	1988-89	2.83	.83	1.25	.45	.0001
Visual Learning	1978-79	2.83	.72	2.00	1.00	.0310
	1983-84	2.75	.87	2.08	.90	NS
	1988-89	2.92	.79	2.08	.90	.0250

Table 2

Responses for Measures of Contact Between the Two Programs for Nine Institutions With Both Chairpersons Responding

Contact Characteristic	ID	EP
Collaborative research/ publication	3 (33%)	2 (22%)
Comprehensive exam committees	5 (56%)	5 (56%)
Dissertation committees	9 (100%)	9 (100%)
Faculty committees	7 (78%)	7 (78%)
Joint faculty appointments	4 (44%)	2 (22%)
Joint program administration	2 (22%)	1 (11%)
Program located in same building	6 (67%)	3 (33%)
Team-teaching	2 (22%)	1 (11%)
Have these interactions increased or decreased in the past 5 years:		
Increased	3 (33%)	4 (44%)
No change	6 (67%)	5 (56%)
Decreased	0 (0%)	0 (0%)
Anticipate an increase in the next five years:		
Yes	4 (50%)	5 (56%)
No	4 (50%)	4 (44%)

EFFECTS OF MICROCOMPUTER DISPLAY ON A PERCEPTUAL/COGNITIVE TASK

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INTRODUCTION

Toward Adaptive Courseware Designs

Assuming that computers will play an incresingly intergral role in the educational and training of individuals in school and non-school settings, more effective ways of utilizing their potential should be investigated. Courseware producers are beginning to transcend the conceptual and instructional constraints imposed by the form of most drill-and-practice and tutorial software. Future efforts should focus, at least in part, on exploiting the interactive and adaptive capabilities of computer assisted instruction rather than merely using the computer as a presentation device for text and graphics. These capabilities permit greater flexibility in courseware than merely providing remedial responses to multiple choice questions. Several levels of interactivity between the user and the computer are possible, as are multiple levels and dimensions of possible adaptations by the courseware to those interactions (Jonassen, 1985). A potentially important adaptive, interactive courseware design diagnoses learners' intellectual skills and/or cognitive styles prior to instruction and then adapts the instructional presentation to capitalize on the individual learner's processing strengths or to remediate the learner's skill weaknesses (Carrier & Jonassen, in press). Ross (1984) recommends "greater emphasis ...on pretask assessments (eg. of prior achievement, learner backgraound, etc.) as bases for adaptation" (p.47). Only through increasingly sophisticated adaptive sequences will the computer begin to realize the tutorial potential of a Socratic dialogue.

Assessing Learner Differences

Many measures of individual differences have evolved from individual, projective tests to take the form of non-projective, paper-and-pencil tests in order to improve the efficiency of the test while maintaing reliability and validity. For instance, the cognitive style, field articulation has evolved from the Body Adjustment Test, which required elaborate apparati, to the Rod and Frame Test, with less elaborate apparati, to the individual paper-and-pencil Embedded Figures Test, and finally to the group administered Group Embedded Figures Test and Hidden Figures Test. The next step is to embed these latter tests into courseware as a means for diagnosing learners' processing preferences. Can we assume that these tests are adaptable to computer display without affecting performance? How will adaptation of these tests to computer display affect their validity and reliability? Will the limited resolution of computer generated graphic presentations affect the information processing requirements of the task?

If instructional adaptations are to be predicated on computer tests of cognitive and perceptual tasks, we need to be certain the computer testing requires the same perceptual and intellectual processes as the paper-and-pencil forms.

Purpose of the Study

The purpose of this study was to adapt the Hidden Figures Test to microcomputer display and to assess its alternate form reliability when compared to the paper-and-pencil test. The Hidden Figures Test (Ekstrom, French & Harmon, 1976) is a popular measure of the cognitive style, field articulation, otherwise known as field dependence/independence. It measures the ability of the subject to perceive and separate information from its surrounding contextual field. Specifically, subjects are required to locate one of five simple figures in several complex patterns (see Figure 1). Subjects who are adept are field independent. They are skilled at separating stimuli from their surrounding perceptual field, that is, their perception is indepedent of the perceptual field in which it is embedded. Field independent subjects are not only more skilled at locating figures in patterns, but also in problem solving and other cognitive tasks requiring learners to select salient cues from their surrounding contextual field, as well as imposing their own structures on information (Witkin et al, 1977). In short, they are more analytical processors of all forms of information. These processing differences are reflected in their social interactions and career choices, with field independents preferring greater interpersonal distances and fewer interpersonal relations. Field articulation has also been related to intelligence, hemispherical preference, deductive reasoning , and a host of other constructs. Since it is one of the most reliable and certainly the most researched cognitive styles, reflecting the most distinguishable processing differences, it it was selected to test the effects of microcomputer display. In a study virtually identical to this one only recently discovered after collecting the data, the paper-and-pencil form of the test produced higher scores, though the alternate form reliability was significant, $r=.57$, $p<.05$ (Jacobs, Byrd, & High, 1985). Only 32% of the variance was explained, however, indicating a weak alternative form reliability. Despite my intention, this study may function as a replication of the earlier study.

METHOD

Instruments

The Hidden Figures Test, Form CF1, Revised, is from the Kit of Factor Referenced Cognitive Tests (French, Ekstrom & Price, 1976). It consists of two parts, each with 16 complex patterns in which are embedded one of five simple figures (see Figure 1). Part one, questions 1-16, was used in its paper-and-pencil form. Part two, questions 17-32, was converted to computer display. It was programmed in Applesoft BASIC for display on 12 inch, monochrome (green screen) monitors with Apple IIe computers. The figures and patterns were constructed in page 1 of Apple high resolution graphics. This provided a four line text window at the bottom of the screen for giving directions. Resolution in this mode is 280 horizontal pixels by 160 vertical pixels. All of the figures and patterns in the computer version were identical in proportion nearly identical in size to those in the paper-and-pencil version. The timing and scoring were the same. The instructions for how to perform the task were taken verbatim from the paper version. To those were added instructions in how to manipulate the screens. The primary difference between the versions was in the number of patterns visible to the subjects at any time. In the paper-and-pencil version, the 16 figures are displayed on two pages, with 3 rows of patterns on each page. Four of those rows contained 3 patterns, and the last 2 contained 2 patterns per row. Because of limited size of the computer terminal, the three rows of figures could not be displayed simultaneously. So, the five simple figures were always displayed at the top of the screen with a single row of patterns (either 2 or 3) displayed in the middle of the screen (see Figure 2). The rows appeared in the same order, arrangement, and proportion as they did in the paper-and-pencil test. Subjects could flip between each of the rows simply by pressing the right or left arrow keys at the bottom of the keyboard. The computer required 1.2 seconds to clear the screen and form the new row of figures. The numbers of the patterns were displayed directly beneath each pattern. The other difference between the two versions was in how the subjects recorded their answers. In the paper-and-pencil test, the letters A-E (corresponding to the figures in the top row) were displayed beneath each pattern. The subjects were instructed to circle the letter corresponding to the figure which they thought was embedded in the pattern. In the computer version, when subjects wanted to answer, they pressed the letter A (for answer). In the text window at the bottom of the screen, they were prompted: "In which pattern did you find a figure?" They were instructed to type a number between 1-16 followed by a return. Any other response but a number between 1-16 resulted in a remdial message instructing them to respond with a number between 1-16. They were next prompted: "Which figure did you find in pattern _pattern number_?" They were prompted to respond with a letter A-E and a return. They were then given confirmation of their response with the opportunity to alter their response, "Figure __ is in

Pattern __. Correct (Y or N)?" A "y" typed in would clear the text window, except for the screen manipulation prompts. All other keys on the keyboard, except the numerals and the letter A-E, Y, and N were deactivated.

Participants

The participants included 58 upper-level undergraduate and graduate students in education and library science at a southeastern university. They were predominately (91.4%) female. The mean score for all subjects was 4.96, which is equivalent to norms for this group established in other investigations. So the participants in this student were fairly normal with regard to the task measured by the test. All subjects had some prior experience with microcomputers, though the level of experience varied.

Procedure

One group ($\underline{n}$=38) was administered the print version of the test first, followed immediately by the computer version. The other group ($\underline{n}$=20) received the computer version first, in order to control for order effect. The tests were always administered in immediate succession. The only delays incurred were for changing rooms, ie. moving to and from the computer lab, which was less than 100 feet away. For each adminstration, the experimenter read the instructions and the subjects completed the sample test items. Any questions were answered prior to the beginning of the test. The Hidden Figures Test is a timed test. Subjects were given 12 minutes to complete each version of the test.

RESULTS

Pearson product momment correlations were calculated for the paper-and-pencil and computer versions of the test. There was a significant relationship between the two versions, $\underline{r}$=.484, $\underline{p}$<.05. The significance of this relationship should be tempered by the fact that the relationship accounted for only 23.4% of the variance between the scores.

In order to test for order effect, a two-way analysis of variance was calculated for the mean scores presented in Table 1. Table 1 indicates that for the group which received the paper version first, the mean scores on both tests were equivalent ($\underline{M}$=4.71). However, for the group receiving the computer version first, their scores on the computer version were significantly lower on the computer version ($\underline{M}$=2.55) than on the paper version ($\underline{M}$=5.20). The analysis of variance indicated no main effect for order of treatment. The paper first group performed better ($\underline{M}$=4.71) on the combined scores than the computer first group ($\underline{M}$=3.875), however the difference was not significant. There was a significant main effect for version of the test, $\underline{F}=5.12$, $\underline{p}<.01$. Scores for the paper version ($\underline{M}=4.96$) were higher than the scores for the computer version ($\underline{M}=3.63$). The interaction was also significant, $\underline{F}=5.12$,$\underline{p}<.05$, indicating a significant order effect for the computer first group only. When the subjects received the print version first, they performed as well on the computer version. However, when they received the computer version first, their performance on the print version improved significantly.

DISCUSSION

There is evidence which indicates that by adapting perceptual and cognitive test, such as those for field dependence/independence, you lose both face and construct validity. Streibel (1981), in a series of experiments with the Embedded Figures Test, found that by increasing the size of the embedded figures by a factor of eight, the nature of the performance was altered. Field dependent subjects became more field independent, and field independent subjects became more field dependent. In this study, serious questions about the face validity of a computer version of the Hidden Figure Test were raised. While there was a significant correlation in the scores on both version of the same test, the analysis of variance indicated that they could not be judged alternate forms of the same test. The performance, as a function of order of testing, varied too extensively. This is especially important when we consider that in a computer managed instructional environment, where the computer would conduct the diagnostic testing, the computer version would replace the print version. The scores on the initial administration of the computer version were significantly lower than the initial administration of the paper-and-pencil version. This lower score corroborates the conclusions of Jacobs et al (1985) that the computer version is probably measuring other constructs such as computer anxiety, which is a function of prior computer experience. There was anecdotal evidence that the perceptual constructs being measured were also different. A number of subjects, especially those in the print-first group thought the computer version was easier, because the diagonal lines generated by the computer (2 pixels wide) were easier to distinguish and compare. Obviously, additional practice with performing perceptual tasks on the computer may well have reduced the effects of computer testing in this study. Additionally, the use of a higher resolution screen may have produced more equivalent performances. This study should be replicated, adding at least one more level of resolution as a test for that factor. The use of computers to administer perceptual and cognitive tests is clearly in the developmental stage. A lot of additional work is necessary before we can assume construct and face validity between alternate (computer vs. print) forms of administration.

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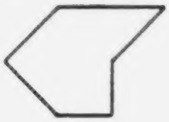
Table 1
Mean Scores by Group on the Hidden Figures Test

	Test		
Order	Paper HFT	Computer HFT	
Paper-Computer	4.71	4.71	4.71
Computer-Paper	5.20	2.55	3.875
	4.96	3.63	

Part 1 (12 minutes)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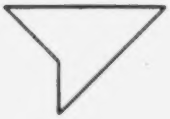
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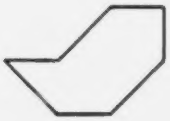
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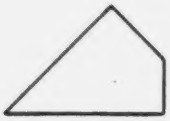
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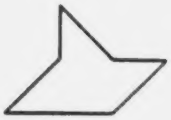
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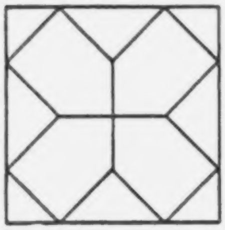
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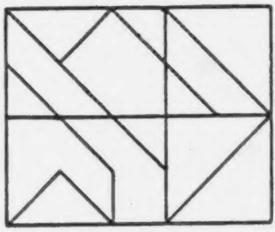
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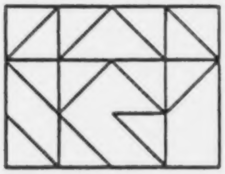
A B C D E

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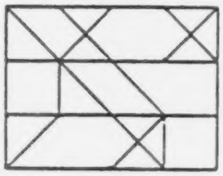
A B C D E

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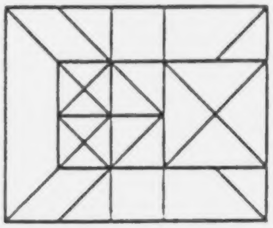
A B C D E

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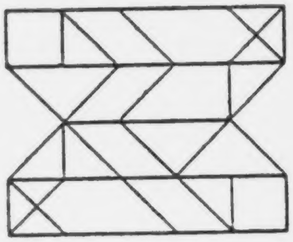
A B C D E

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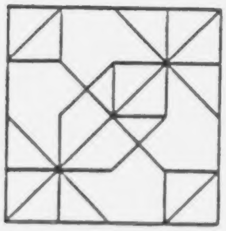
A B C D E

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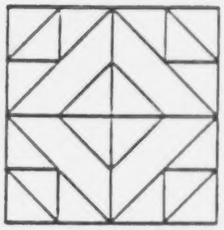
A B C D E

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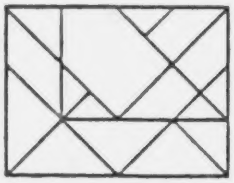
A B C D E

Figure 1
Paper-and-Pencil Version

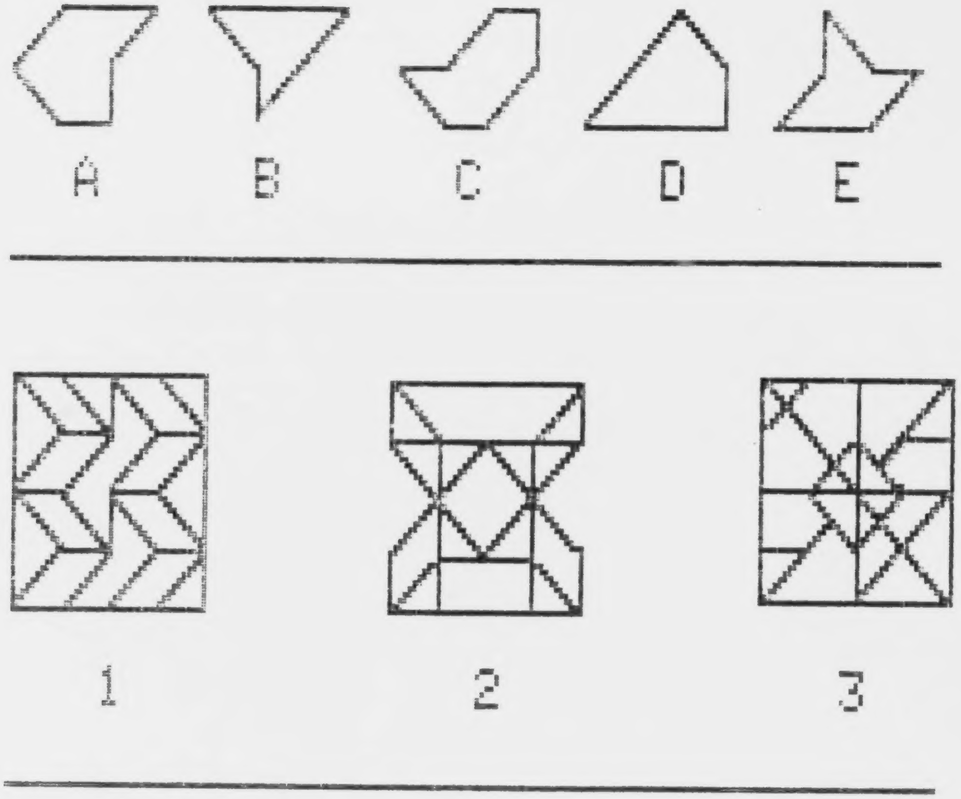

Figure 2
Computer Version of HFT

STATE ANXIETY AN EXPOSURE TO MICROCOMPUTERS: ASSESSING COMPUTERPHOBIA

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Paper presented at the Annual Meeting of the
Association for Educational Communications and Technology
Las Vegas, Nevada, January 19, 1985

INTRODUCTION

It is generally accepted that the exponential growth of microcomputers in education and the workplace has produced an adverse reaction in many people that is referred to as "computerphobia", ie. fear of computers. According to Jay (1981), those suffering from computer phobia:

* are resistant to talking or thinking about computers,
* have hostile and aggressive thoughts about computers, and
* fear and become anxious about computers.

Another, more widely used term for computer phobia is computer anxiety. Computer anxiety results from fear or apprehension when using computers or when faced with the prospect of using computers. Such fears may be rational or irrational. Many people have perfectly normal reasons for fearing computers (Rubin, 1983), such as fear of displacement, loss of control, no time to learn to use them, fear of failure, fear of breaking the computer, and (inevitably) unclear documentation. Such fears, he documents, often produce the hostile reactions toward computers. Irrational fears, those without explanation, are the cause of computerphobia, which in turn results in computer anxiety. Maurer and Simonson (1984) enumerate behaviors that are associated with computer anxiety, such as:

* avoidance of computers and the area in which they are located,
* excessive caution,
* negative remarks, and
* attempts to cut short the necessary use of computers.

Computer anxiety is generally regarded as an instance of state anxiety. State anxiety is situational, that is, it results directly from some stress-producing situation during a finite period of time. Raub (1981) contends, however, that the state anxiety associated with computer phobia will more likely result in people with higher trait anxiety. Trait anxiety is a more enduring and permanent characteristic tendency to be anxious.

Computer anxiety tends to be gender specific, with many more women fearful of computers because socialization makes them less receptive to computers (Winkle & Matthews, 1982). Computer equity is an important issue which should stimulate affirmative action efforts (Bakon, et al, 1983).

While computer anxiety is a generally accepted phenomenon, its existence is often based on anecdotal data. We have no empirical proof of its existence, which raises the possibility that it may be more constructed than real, based upon our expectations. Sociologically speaking, there is good reason to expect computer anxiety. As we have all sat down to learn a new software package, we have felt the pangs of anxiety. Yet, there is no support for the pervasive effects that are often documented in the literature. The purpose of this study was to emprirically document whether increased levels of state anxiety are in fact associated with the use of microcomputers, thereby producing the anxiety-related behaviors enumerated by Maurer and Simonson (1984). While they used the same instrument as this study, the results were used to validate a Computer Anxiety Inventory rather than to establish the existence of computer anxiety. In addition, they administered the anxiety measure in its print form. In order to assess whether state anxiety increases when using microcomputers, the state anxiety measure in this study was administered by the computer.

METHOD

Participants

116 undergraduate and graduate education and library science majors with an age range of 20 to 55, enrolled at a southeastern university.

Instruments

State-Trait Anxiety Inventory, Form Y (Spielberger, 1983) is an inventory which assesses levels of anxiety states, such as tension, apprehension, worry, etc. Based upon the personality theory outlined by Spielberger (1972), the test is divided into two parts. Part 1 assess state anxiety, a transitory, momentary state of anxiety. These personality states can become more stable over time. Trait anxiety, as measured by the STAI, refers to a stable individual difference of anxiety proneness which may result in elevated state anxiety in situations perceived by the person as threatening. The trait portion was adminstered to all participants in its print form. Half the participants also received the print form of the state portion of the test. The state portion was converted to an auto-boot program for the Apple IIe which presented each question individually with the likert scale presented beneath each question (see Figure 1). After answering, subjects were asked to confirm their responses. This enabled them to change their responses because of a change of mind, keyboarding error, etc. After the 20th question, an additional question was presented which asked the participant to classify the level of their computer expereince (from "Never used one" to "Use one all the time". The computer then wrote the participants' answers off to disc. A program was written to score the state tests and print out the results.

Procedure

The control group (58 students) received both portions of the test in a normal classroom environment. The experimental group (58 students) received the trait portion in class and then proceded to the computer lab for an introductory lesson in computer assisted instruction during which they completed the state portion of the test on the computer.

RESULTS

Exposure to Computer

The means for the two groups (N=58 each), one completing the state anxiety portion online and the other completing it in print form, were compared statistically. No significant difference between the groups were found, $t(114)=1.34$, $p>.05$. The state anxiety scores of the computer group ($M=48.24$) were substantially higher than the print group ($M=36.12$), but within group variance was so high for the computer group that no statistical difference occurred. The trait anxiety scores ($M=36.59$ and $M=36.79$) were virtually equivalent, $t(114)=-0.13$.

Level of Computer Experience

At the end of the computer-administerd state anxiety inventory, participants were asked to classify on a five-element semantic differential their level of experience with microcomputers. Based upon their declared levels of experience, they were broken into five groups of unequal size with the most indicating a moderate level of experience and only three indicating a high level of experience. An analysis of variance of the state anxiety scores of these five groups indicated no significant difference, $F(4)=0.83$, $p>.05$.

Sex Differences

Only six members of the experimental group were males. Their level of state anxiety, predictably lower from the literature, were in fact slightly lower ($M=46.12$) than the females ($m=48.36$). The difference however was not significant, $t(56)=-0.36$,$p>.05$. There was no difference in trait anxiety scores either.

DISCUSSION

This study provides some statistically inconclusive evidence of increased anxiety states when exposed to microcomputers. For many educators, they are still novel enough to produce some anxiety. An increase in state axiety should be mitigated by increased exposure to microcomputers. Microcomputers do not produce irrational fear among educators, as evidenced by this study. The setting (moving from the classroom to a computer lab) could have produced the marginal increase in state anxiety. The stongest predictor of state anxiety was still trait anxiety, $F(2)=12.10$, $p<.05$, although it accounted for less than 10% of the variance. The treatment factor added no significant amount to that. It appears that these results, like most produced by educational research, are greatly affected by individual differences, as indicated by the high level of within-group variance.

The computer equity issue was not supported by this study, although the inequity in group size makes the analysis suspect. For this group of professional and pre-professional students, anxiety toward computers should not be as great as among younger students. Most of the large sex differences seem to occur in junior high and high school.

The solution for computerphobia or computer anxiety is computer literacy (Lawton & Gerschner, 1982). Computer tension may also be reduced by using a comparative organizer to relate computer using decisions to the more familar process of selecting and using a classroom film (Rottier, 1982). This metaphorical approach is the basis for developing elaborate "training wheels systems" described in the human factors literature.

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Figure 1

Sample Run of Computer Version, SAI

```
1. I FEEL CALM....................
  ------------------------------------
  ------------------------------------
   ENTER THE NUMBER THAT DESCRIBES HOW
   YOU FEEL ABOUT THE STATEMENT ABOVE
   AT THIS MOMENT.
               NOT AT ALL.........1
               SOMEWHAT...........2
               MODERATELY SO......3
               VERY MUCH SO.......4
```

—————New screen

```
ARE YOU SURE THAT YOU MEAN 1?
         (Y OR N)?
```

——————New screen

```
2. I FEEL SECURE..................
  ------------------------------------
  ------------------------------------
   ENTER THE NUMBER THAT DESCRIBES HOW
   YOU FEEL ABOUT THE STATEMENT ABOVE
   AT THIS MOMENT.
               NOT AT ALL.........1
               SOMEWHAT...........2
               MODERATELY SO......3
               VERY MUCH SO.......4
```

-------New screen

```
ARE YOU SURE THAT YOU MEAN 3?
         (Y OR N)?
```

-------New screen

```
3. I AM TENSE.....................
  ------------------------------------
  ------------------------------------
   ENTER THE NUMBER THAT DESCRIBES HOW
   YOU FEEL ABOUT THE STATEMENT ABOVE
   AT THIS MOMENT.
               NOT AT ALL.........1
               SOMEWHAT...........2
               MODERATELY SO......3
               VERY MUCH SO.......4
```

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List vs. Flow Chart Representations of Algorithms for a Search Task

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Paper presented to
Research and Theory Division
at the Annual Meeting of the
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ABSTRACT

This study compared the efficiency (time) and accuracy of list versus flow chart representations of the task of using indexes to search for document numbers in the U.S. Documents Monthly Catalog. Participants independently used the algorithms and were timed in a real world setting. Both groups performed at a 92% accuracy level. Both groups required virtually identical times to locate document numbers using each of the four indexes of the catalog, though the range of time and resultant variances were high. It appears that the form of representing algorithms has no effect on the algorithmic process during a search task.

INTRODUCTION

Algorithms are often used in education to depict general procedures which describe a class of problems. Algorithmic procedures normally are distinguished from linear procedures, which are represented as sequential lists of discrete operations. Algorithms, on the other hand, represent decision rule procedures in which a set of rules is systematically employed to make decisions and take appropriate actions. Algorithms are designed so that they always produce the correct result, given any of a class of decision rule problems. They may serve as instructional media or as job performance aids, which indirectly instruct users. Numerous studies have verified the effectiveness and efficiency of algorithms as instructional media (Landa, 1974; Scandura et al, 1971; Schmid et al, 1976).

While many people associate instructional algorithms with flow charts, Merrill (1980) illustrated four different representations for algorithms -- decision tree, decision table, flow chart and list representations. In this study we compared the efficiency and accuracy of two of the more popular representations, flow chart and list representations, for facilitating a search task. Very little research was availble to assist us in generating hypotheses. Coscarelli (1978) reported that the form of representation (list vs. flow chart vs. prose) did not affect critical thinking ability or course grades, however, using flow chart algorithms, students reduced their completion times. Coscarelli (1978) believed that different representations for algorithms possessed different media codes, which should affect the recoding of information into mental operations. Recoding differences should result in performance differences. In a study employing limited information processing tasks, flow charts were found to produce faster decision making than lists, with an equivalent level of accuracy (Holland & Rose, 1981). Evidence seems to indicate that flowchart representations of algorithms enables users to learn more efficiently. The questions that we addressed was, would these results generalize to a meaningful search task performed witout assistance in a real-world setting?

METHOD

Participants

55 undergraduates and 5 adults at the Virginia Military Institute (26 male, 4 female).

Materials

Two sets (flow chart and list) of six algorithms were developed and field tested. Each set of algorithms depicted the decision-rule procedure for using each of the indexes (subject, author, title, and keyword) and locating document numbers in the Monthly Catalog, the primary accession tool to U.S. Government Documents in depository libraries. The first algorithm in each set presented decisions which led to the appropriate algorithm and index. Each of the next four algorithms in each set directed the users through each of the indexes (see Figures 1 and 2 for examples of both types of algorithms for one index). The final algorithm showed how to find the document number in the catalog. The algorithms consisted of an average of 3 decision steps and 5 action steps. The flow chart versions used four common flow charting figures (rectangle, diamond, oval, and circle) to represent action, decision, terminal, and connector steps respectively. The steps for the list representations used the same directions presented in a numbered list sequence, with decision options referencing different step numbers. Both sets of algorithms were presented on six 8 1/2" X 11" pages.

Procedure

Content validity was established by submitting the materials for review by the head documents librarian and a library science professor. Then, each set of algorithms was pilot tested with naive users. No changes were found necessary. The participants in the study were unfamiliar with either the Monthly Catalog or the use of algorithms. They were randomly assigned to treatment group (list and flow chart). Each was first given an instruction sheet and practice exercise on how to use their respective type of algorithm. Next, all participants were presented individually with the set of algorithms and a set of four problems, each requiring the use of a different index in order to locate a citation and then the document number. That is, the search required each user to use one algorithm to determine the needed index, a second index-specific algorithm to find the citation, and a third to locate the SUDOC number. Only the Monthly Catalogs for the years 1980-1983 were used for searching, in order to limit the scope of the task. The order of the problems was randomized. Each participant was individually timed as s/he worked through the algorithms in order to locate the document number taking as long as they needed to locate it. They were told not to request assistance unless absolutely necessary. Following treatment, each participant completed the Extended Range Vocabulary Test from the Kit of Factor Referenced Cognitive Tests as a global measure of verbal ability.

RESULTS

Verbal ability

There was no difference between groups on the first part of the Extended Range Vocabulary test (M(list)=12.47 and M(flow chart)=12.93). We concluded that both groups were equivalent in their reading ability.

Accuracy

Both groups completed the questions with 91.7% accuracy. The flow chart group ($n=9$) had a significantly greater number of requests for assistance than did the list representation group ($n=2$), $\chi^2(1)=5.67$, $p<.02$. These requests related to the procedure for locating the indexes or which index to locate.

Time

Only minute differences in the times required by participants to locate documents resulted (see Table 1). The list group ($M=5.24$) completed their problems only slightly faster than the flow chart group ($M=5.28$). The range of times was very high, producing a large amount of variance in the data. The analysis of variance indicated a significant main effect. Post hoc analysis indicated the the title problem required significantly less time ($M=4.39$) than the other questions ($M=5.42$). The question by treatment interaction was not significant indicating no differntial effects of treatment.

CONCLUSIONS

The use of algorithms to introduce search procedures is effective insofar as most of the naive users were able to locate the information they sought independently. Also, the experience was positively received by all participants. Most of them reported positive attitudes toward the use of algorithms. Since the effectiveness of algorithms relative to list procedures has already been established, this study was concerned with alternative methods for representing the same algorithmic process. However, the form of representation appears to have little effect on the efficiency of the search. The accuracy of the search does not seem to be affected either, at least in terms of the proportion of citations located. Holland and Rose (1981) recommended practice with algorithms prior to performance because they (both list and flow chart) are generally unfamiliar forms of instruction. They found that the flow chart, after practice, elicits the best performance. The greater number of requests for assistance in this study by the flow chart users was probably attributable to the novelty of that form of instruction. So, with practice, the efficiency of the flow chart group in this study might have improved. Practice with any procedure is important. However, it was deemed likely that in an engineering-oriented, predominantly male school (such as the one in which the study was conducted) that some of the participants were familiar with flow charting. The intent of this study was to investigate the use the algorithms for providing independent access to materials in order to supplant the need for personnel to assist in the process. While either form may be used with equivalent efficiency and resultant accuracy, the additional requests for assistance, if found to be a consistent trend among naive users, would suggest the preferred use of list algorithms.

However, the efficiency and resultant accuracy of the two different forms of algorithms in this study suggest that it is the technology of algorithmization that makes the processing difference - not the form of its representation. The media codes are structural and therefore implicit in the algorithmic process and not specific to its form of representation.

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Table 1
Mean Location Times for Indexes by Type of Algorithm Used

	Author	Title	Subject	Keyword
List	6.05	4.11	4.97	5.48
Flowchart	5.49	4.85	6.04	5.51

Table 2
Results of Two-Way ANOVA

	Sum of Squares	Degrees of Freedom	Mean Squares	F
Type Search	29.01	3	9.67	1.16
Treatment	3.05	1	3.05	0.365
Type X Treat.	12.05	3	4.02	0.481
Error	935.69	112		
Total	979.81	119		

Figure 2

List Representation of Algorithm

1) Start here with the AUTHOR of a government document.

2) Find the CUMULATIVE AUTHOR INDEX to the Monthly Catalog. The indexes, along with the Monthly Catalog, are located on Index Table .

3) Select the AUTHOR INDEX volume for the year your document was published. If you do not know the year, use your best guess.

4) Is your AUTHOR one or more persons? If yes, go to Step 5. If no, go to Step 6.

5) Select one of your AUTHORS and look up the last name, followed by the first name or initials. Go to Step 7.

6) Your AUTHOR must be a corporate or government agency. Look up the first major word in the corporate agency. Do not use a, an, the.

7) Did you find your AUTHOR? If no, you may have the wrong year. Go back to Step 3 and select the year earlier or the year later. If yes, go to Step 8.

8) There may be more than one title attributed to your AUTHOR. Select the one you want. Find the ENTRY NUMBER following the title.

9) The ENTRY NUMBER looks like this: 83-16997. The first two digits (83) indicate the year and volume number of the Monthly Catalog.

Write down your ENTRY NUMBER.

10) Find the volume of the Monthlv Catalog for the year indicated by your ENTRY NUMBER. ENTRIES are listed in numerical order. The numbers contained in a volume are indicated on the spine.

11) Did you find your ENTRY? If no, you may have the wrong volume. Look at the inclusive numbers listed on the spine to see if yours fit. Go back to Step 10. If yes, go to Page 6.

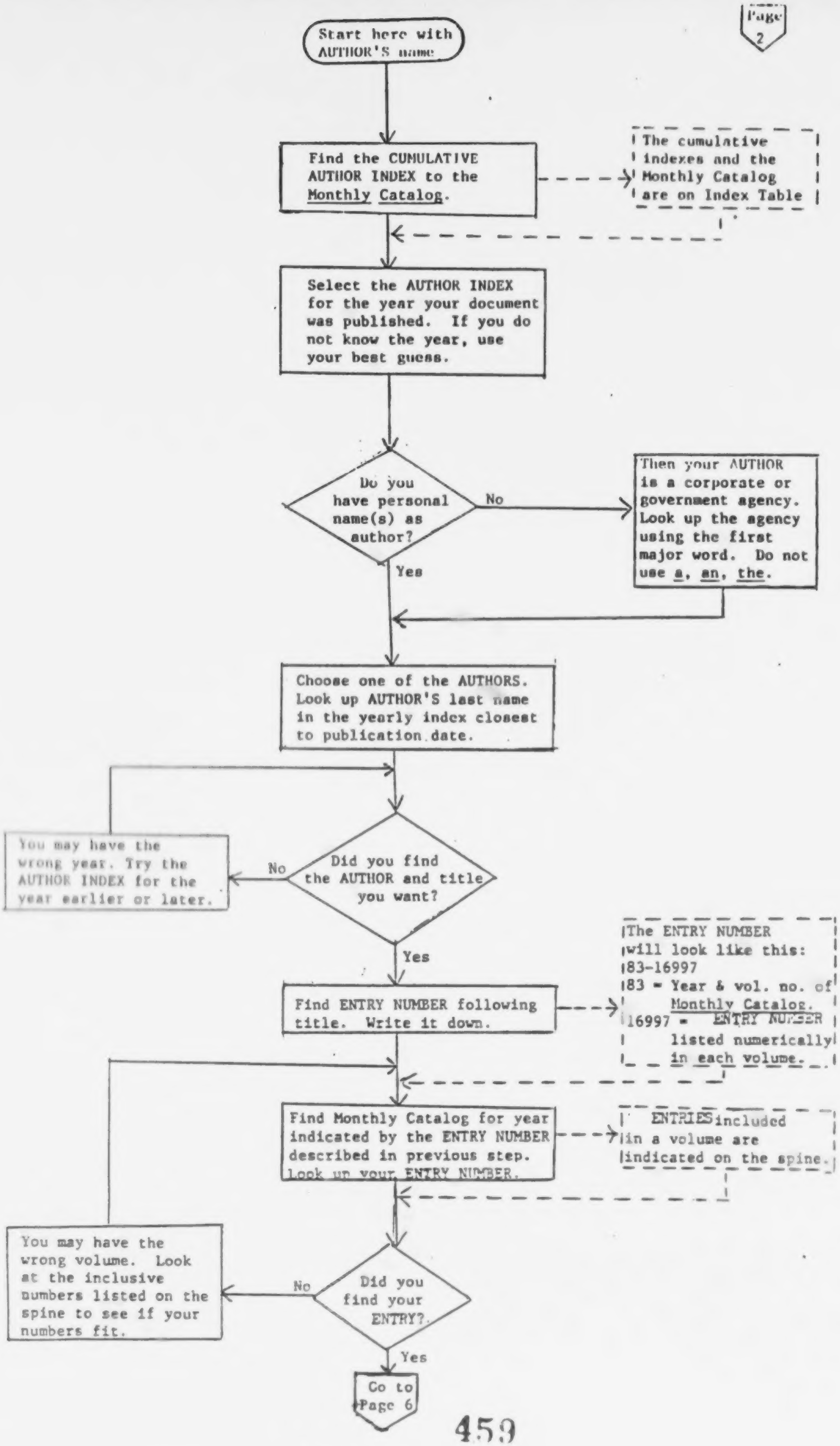
Page 2
Start here with AUTHOR'S name
Find the CUMULATIVE AUTHOR INDEX to the Monthly Catalog.
The cumulative indexes and the Monthly Catalog are on Index Table
Select the AUTHOR INDEX for the year your document was published. If you do not know the year, use your best guess.
Do you have personal name(s) as author?
No
Then your AUTHOR is a corporate or government agency. Look up the agency using the first major word. Do not use a, an, the.
Yes
Choose one of the AUTHORS. Look up AUTHOR'S last name in the yearly index closest to publication date.
Did you find the AUTHOR and title you want?
No
You may have the wrong year. Try the AUTHOR INDEX for the year earlier or later.
Yes
Find ENTRY NUMBER following title. Write it down.
The ENTRY NUMBER will look like this:
83-16997
83 = Year & vol. no. of Monthly Catalog.
16997 = ENTRY NUMBER listed numerically in each volume.
Find Monthly Catalog for year indicated by the ENTRY NUMBER described in previous step. Look up your ENTRY NUMBER.
ENTRIES included in a volume are indicated on the spine.
Did you find your ENTRY?
No
You may have the wrong volume. Look at the inclusive numbers listed on the spine to see if your numbers fit.
Yes
Go to Page 6

Figure 2

Flow Chart Representation of Algorithm

THE 1983-84 MARYLAND ITV
UTILIZATION STUDY SUMMARY REPORT

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LAS VEGAS, NEVADA
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INTRODUCTION

BACKGROUND

In November of 1983, the Maryland State Department of Education (MSDE), Division of Instructional Television, requested that we undertake a study to determine the present usage of instructional television within the public schools of Maryland. One such study had been conducted by Johnson and Keller in 1981. Essentially, the proposed study would replicate and update the Johnson and Keller study. We were very pleased to conduct this study since, to a large extent, the objectives of the study coincided with our own interests in the utilization of television in Maryland public schools. In January of 1984, we prepared a proposal for the study which was subsequently approved by Maryland Instructional Television (MITV) and by the Council for Statewide Planning of Educational Information Systems (CSPEIS). The study was conducted during the spring of 1984. It was essentially a sample survey, utilizing mailed questionnaires. Data collection was completed for the project by late May in 1984 for all Maryland school systems except one.[1] Final data collection was completed by November 1984.

PURPOSE

The study's purpose was to determine the present usage of ITV in the public schools of Maryland. As with the Johnson and Keller study, data was collected relevant to four questions:

1. To what extent is ITV available in the Maryland public schools?
2. To what extent are teachers, principals, library media specialists and system ITV coordinators committed to the area of ITV?
3. To what extent is ITV actually used in Maryland public schools?
4. In general, what attitudes toward ITV are held by teachers, principals, library media specialists, and system ITV coordinators?

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[1] One county (Montgomery) requested that data collection from principals and teachers be delayed until September 1984. Data collection from these individuals was completed by late November 1984.

RELATED STUDIES

A comprehensive national study regarding the utilization of television in the public schools was sponsored by the Corporation for Public Broadcasting (CPB) and the National Center for Educational Statistics (NCES) in the 1976-1977 school year. The study was directed by Peter Dirr and Ron Pedone. The Dirr and Pedone study was representative of 12,000 school systems and 2,275,000 classrooms. The results indicated that instructional television was used by one out of every three teachers and that approximately fifteen million students received a regular portion of their instruction via television. While the results of this study were highly significant in terms of national usage, it provided limited benefits to assist in planning at the state level.

In order to provide more data specific to the utilization of instructional television within Maryland, the Maryland State Department of Education, Division of Instructional Television, sponsored a statewide survey in 1981. The first Maryland ITV study was directed by Kerry Johnson and Paul Keller and was modeled after the Dirr and Pedone study. Like the national study, the Johnson and Keller study collected survey data relevant to availability, commitment, actual use, and attitudes toward ITV. The Maryland study utilized data collection questionnaires which were modifications of the instruments used in the national study. Johnson and Keller found that utilization of ITV in Maryland closely followed national trends. For example, they found that ITV was widely available in Maryland and that 42.4% of teachers used ITV in 1981. Other findings indicated that ITV had become an accepted feature of instruction in Maryland public schools.

METHOD

The present study replicated the Johnson and Keller study in order to assess the current status of ITV utilization in the public schools of Maryland and to compare current usage with that of the 1980-81 school year. In order to obtain results which would be comparable with the 1981 study, it was decided to design questionnaires which would closely follow those of the 1981 study. Design of the instruments followed three principles. (1) they must closely match those used in the 1981 study in order to obtain useful comparable results; (2) they should include items to collect data relevant to current needs of MSDE; (3) they should be streamlined to ensure ease and accuracy of response. With those in mind, we first determined what additional information was needed by MSDE and by ourselves and then designed items to collect such data.

Second, we reworked the instruments to ensure ease of response and to week out ambiguous item. Effort was directed toward decreasing the time required to respond and toward improving accuracy of response. Since the 1981 study had not obtained usable data from school superintendents, it was decided that the instrument which had been used in 1981 should be redesigned and sent to system ITV coordinators. It was felt that the system coordinators would more likely be the ones with the needed information and that they would be willing to participate in the study. The subsequent return rate among ITV coordinators (96%) proved these assumptions to be true.

Separate questionnaires were designed for teachers, library media specialists, principals, and ITV coordinators. The questionnaires were organized around the four major study questions: availability of ITV, commitment to ITV, actual use of ITV, and attitudes toward ITV. The prototype questionnaires underwent informal field testing to identify problem items and ease of response. After the initial field testing, it was decided to use professionally printed and color-coded questionnaires that would be attractive and easy to complete. The design of the questionnaires was greatly helped by the fact that the instruments used in the Johnson and Keller study were suitable to be updated and refined.

SAMPLE

The population of this study included all public schools in Maryland. We were interested in obtaining results which would ensure representation of all systems and proportional representation of elementary, middle, and high schools. Consequently, we employed a variation of stratified random sampling which yielded a sample of 209 Maryland public schools. In each school selected, instruments were to be completed by the principal, the library media specialist, and five classroom teachers, the latter randomly selected by the principal. In addition, the ITV coordinator for each public school system received an instrument. The final sample selected was comprised of 24 ITV coordinators, 209 library media specialists, and 1,045 teachers.

ADMINISTRATION

In February of 1984, a letter was sent to each of the superintendents in the state explaining the purpose of the study and requesting their cooperation. The collection of data began with the mailing of letters to each school principal on April 13, 1984. The principals' letters explained the purposes of the study and detailed procedures which were to be followed when the questionnaires were mailed. Questionniare packets and letters to the 209 principals were mailed during May 2-9, 1984. Each packet sent to the principals contained a principal's questionnaire, a questionnaire for the library media specialist, and five questionnaires for classroom teachers. The packet included instructions for completing the questionnaires as well as the procedure to be followed in randomly selecting the classroom teachers. ITV coordinators received questionnaires and letters of explanation the week of May 17, 1984.

In order to increase the response rate of the study, a follow-up letter was sent June 5-7, 1984, to all schools which had not responded. A sample of the follow-up letter is included in Appendix I. Telephone follow-ups of those remaining, including ITV coordinators, were conducted from June 6 to 20, 1984.[2]

THE DATA

Data for this study consists of responses of a sample of 618 classroom teachers, 149 library media specialists, 166 school principals and 23 system ITV coordinators to their respective questionnaires.

The results of the questionnaire mailings and collection were:

	Questionnaires Sent	Questionnaires Returned	Questionnaires Returned (%)
System ITV Coordinators	24	23	95.8
Principals	209	166	79.4
Library Media Specialists	209	149	71.3
Classroom Teachers	1045	618	59.1
Total	1487	956	64.3

Analysis of the data consisted of categorization of responses by elementary, middle and high school levels. Percentages reponding in each question category by level were calculated for each survey item.

---

[2] The schedule for Montgomery County principals and teachers was: questionnaire packet mailed - September 10; first follow-up - September 18; telephone follow-up - November 5.

RESULTS

The purpose of the study was to determine the present usage of ITV in Maryland public schools. Data were collected relevant to four major indices of utilization: availability of ITV, commitment to ITV, use of ITV, and attitudes toward ITV. Data were collected from four categories of school personnel: teachers, principals, school library media specialists and system ITV coordinators.

AVAILABILITY OF ITV

The following results were obtained relevant to the availability of ITV in Maryland public schools:

89.0 percent of teachers, 98.8 percent of school library media specialists, 93.6 percent of principals and 100 percent of system ITV coordinators reported that ITV programing was available in their schools. ITV was most frequently available via on-air direct broadcast. Next in frequency was cassette-videotape, cable TV, and closed circuit TV. Less than 5 percent of schools reported having or using videodisc equipment.

Closely related to the availability of ITV is the availability of television sets for classroom use. 83.7 percent of teachers reported that it was "easy" or "pretty easy" to have access to a TV set. Sets were reported to be in good repair "always" or "most of the time" by 87.8 percent of teachers, 92.8 percent of school library media specialists and 91.9 percent of principals. The quality of television reception was reported to be "good" or "fair" by 91.1 percent of teachers, and by 92.4 percent of principals.

Scheduling of ITV programs was reported to be the most serious difficulty in using ITV. When asked about the degree of difficulty in obtaining a video recording (to overcome the scheduling problem), teachers responded as shown:

VIDEO RECORDING DIFFICULTIES

Easy	19.0
Pretty Easy	24.6
Sometimes Can't	9.9
Not Easy	8.0
Never Tried	26.0
No Facilities	11.9

When asked about the specific difficulties in using ITV, the group surveyed reported as shown:

DIFFICULTIES IN USING ITV

Program Scheduling	39.9
Set Availability	14.8
Advance Program Notice	9.5
Set Quality	8.7
Enough Planning Time	6.9
Set Maintenance	3.9
Set in Class	3.3
Schedule/Guide Availability	2.8
Program Quality	2.2
Availability of Assistance	1.1
Others	6.9

COMMITMENT TO ITV

The following results were obtained which were relevant to the question of the extent to which teachers, principals, school library media specialists and system ITV coordinators were committed to the use of ITV.

One indication of commitment used in the questionnaire was whether or not schools had designated someone as the ITV coordinator. We found that principals and teachers disagreed somewhat on this question. When we asked if there was a building person responsible for ITV, the following results were obtained:

BUILDING ITV COORDINATOR AVAILABLE

	Teachers	Principals
Full Time	20.4	31.4
Part Time	12.8	20.6
Informal	26.5	24.5
None	40.4	20.8

Of those schools which reported having an ITV coordinator, teachers reported that the following services were provided:

ITV COORDINATOR SERVICES

	Teachers
Distributes Guides/Schedules	2.6
Works with Students	16.1
Provides Training/Consultation	19.4
Provides Newsletter	25.8
Calls Attention to Program	38.7
Provides Equipment Assistance	74.2

Systems ITV coordinators were asked to report upon the upgrading or expansion of ITV facilities in their respective systems. Coordinators were asked what had been done during the past three years, as well as what was planned for the next three years. The following data were reported:

ITV FACILITIES UPGRADING

	Done in Past 3 Years	Planned for Next 3 Years
Increased the number of TV sets	46.6	43.4
Added Video Equipment	73.9	52.1
Expanded Videotape Libraries	73.9	52.1
Added Master Antenna	39.1	30.4
Added Production Equipment	47.8	30.4
Added Videodisc Equipment	0.0	8.7

USE OF ITV

The study asked teachers to respond to several items in order to determine how and to what extent ITV was used. Teachers reported that they frequently view ITV as a whole class (74.9 percent), but that it is also very common (77.9 percent) to view ITV with another class.

When asked how much time they spend watching ITV, 52.8 percent of all teachers reported watching at least 1/4 hour of ITV each week. 58.9 percent of elementary, 41.3 percent of middle and 43.4 percent of high school teachers reported watching at least 1/4 hours per week. Most teachers (87.6%) felt the maximum appropriate time for viewing ITV was between 1/2 hour and four hours per week. When teachers were asked about student outcomes which they would attribute to ITV, the following results were obtained:

TEACHERS' REPORT OF OBSERVED ITV OUTCOMES

Expanded Knowledge	48.3
Expanded Vocabulary	37.7
Students Follow-Up Ideas	45.3
More Enthusiastic About School	23.2
Use Library More	17.1
Watch More ITV at Home	27.1
Calming Effect	46.6
Others	3.9

When asked to which types of students ITV was most useful, teachers reported that ITV was most useful to all students (79.0 percent) rather than for special abilities students.

ATTITUDES TOWARD ITV

Teachers, principals and school library media specialists were asked how they percieved the general attitudes of other groups toward ITV. The following results were obtained:

TEACHERS

	Favor	Neutral	Against
Students	68.1	31.7	0.2
School Library Media Specialists	67.1	32.1	0.8
Other Teachers	48.5	50.3	1.2
System Office	40.6	57.3	2.1
Chairs/Subject Specialists	39.6	59.7	0.7
Other Specialists	31.2	67.9	0.9
Parents	24.0	70.2	5.8

SCHOOL LIBRARY MEDIA SPECIALISTS

	Favor	Neutral	Against
Students	68.1	31.7	0.2
Teachers	66.9	32.4	0.7
Principals	61.9	35.1	3.0
Chairs/Subject Specialists	52.2	46.8	1.0
Other Specialists	46.4	53.6	0.0
Teachers' Organizations	43.0	57.0	0.0
Parents	25.9	74.1	0.0

PRINCIPALS

	Favor	Neutral	Against
School Library Media Specialists	76.0	23.9	0.0
Teachers	63.8	36.2	0.0
Subject Specialists	53.2	46.8	0.0
Students	62.-	37.5	0.0
Other Specialists	43.4	55.8	0.8
Teachers' Organizations	39.8	60.2	0.0
Parents	37.0	60.7	2.2

The three groups generally view the groups listed as being positive or neutral toward the use of ITV.

CONCLUSIONS

Based upon the results of this study, the following conclusions were made:

1. ITV continues to be widely available in all Maryland public schools. While some differences in perception of availability occurred between principals, teachers, school library media specialists and systems ITV coordinators, it is clear that programing is available to more than 90 percent of all schools. In addition, television sets are available and most teachers feel that it is relatively easy to obtain a set for classroom use.

2. The most serious problem related to availability continues to be scheduling. Some hope to improving this condi-

tion lies in the increase in the availability of video recording equipment in individual schools.

3. There is a commitment to ITV as indicated by the increase in ITV equipment and facilities during the past three years as well as plans for increases during the next three years.

4. The perception of attitudes toward ITV is generally positive. Teachers, principals, and school library media specialists perceive that significant groups within the educational environment are either neutral or positive toward the use of ITV.

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DESCRIPTIVE STUDY OF NONCOMMERCIAL FM RADIO STATIONS AFFILIATED WITH COLLEGES AND UNIVERSITIES

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Abstract

FM radio in higher education has been an under appreciated resource for programmatic development by sponsoring institutions. Radio, in general, has suffered from the introduction of newer technologies. The current status of noncommercial radio has been overlooked by most media researchers. This study examines variables surrounding noncommercial radio stations affiliated with colleges and universities as they are in the early 1980's.

DESCRIPTIVE STUDY OF NONCOMMERCIAL FM RADIO STATIONS AFFILIATED WITH COLLEGES AND UNIVERSITIES

Overview - Perspective

FM radio in higher education has long been the forgotten resource for programmatic development by sponsoring institutions. Radio has suffered from the introduction of alternative technologies and the waivering of visible support. The current status of these radio stations has been overlooked by most media researchers, creating a substantial void in the available descriptive and comparative literature.

It is hard to believe, but radio was originally noncommercial and educational. The first radio station is generally accepted as being KDKA in Pittsburgh, Pennsylvania, which started regular broadcasts in 1920. Many colleges and universities, especially in the midwest, rushed to join the radio bandwagon in the early days, and have continued to do so in the post World War II era.

The complexities involved with noncommercial radio operation have been noted in the literature. Among these problems associated with educational radio at colleges and universities commonly cited in past studies include lack of adequate budgets and personnel (Aarnes, 1949; Halverson, 1947; Rashidpour, 1965; Note 1).

Any group of organization that has expanded as rapidly as has college and university radio cannot have done so without some growing pains. Like many such phenomena, the history of college and university radio reflects a multitude of developments, relationships, and interdependencies. It is filled with many successes as well as failures. College and university radio has never been stagnant, yet its path has rarely been smooth. It is therefore necessary and helpful to conduct periodic re-examinations of this organization. This project presents various aspects of, and observations on, the operation of college and university radio broadcast facilities.

The Study

The study the investigators wish to report, serves to establish a framework for current and future documentation of FM radio affiliated with institutions of higher education. The study examines the current state of college- and university-affiliated noncommercial FM radio stations. The research presents data in that describes the organizational attributes of college- and university-affiliated stations as it applies to the following areas:

1. Basic description of institutions housing noncommercial radio stations

2. Operating budgets

3. Stations organization and personnel, professional involvement, technical support, student involvement
4. Station operating hours
5. Station programming
6. Station philosophies.

In this way it is possible to develop a description of college and university FM operations today.

Population

Because of the broadcasting's movement toward general deregulation, coupled with the FCC edict banning 10 watt stations, it is somewhat difficult to arrive at an exact count of FM stations owned by colleges which are in operation today.

The organization which attempts to make accurate yearly compilations of radio and television stations is Broadcasting Publications, Inc., which first started publishing in the 1920s. Their Broadcasting Yearbook points out that there are 670 stations which are housed on a college or university campus or are licensed to one.

After consulting with several experts in the field of educational radio, it was concluded that the best, most available and authoritative source which would identify the wanted population most accurately was indeed Broadcasting Yearbook. Therefore, a total population was identified and derived from information in the 1982 Broadcasting Yearbook that met the following criteria: (1) that it carried a noncommercial designation; (2) that it was either licensed to a post high school organization or, according to its address, was housed on a college or university campus. Some met all criteria, others were licensed to a college or university but carried post box number addresses. The working universal population for this work was determined at 670.

Limitations and Assumptions

LIMITATIONS

1. This study does not explore:
    a. Station equipment
    b. Salaries paid personnel
    c. Physical size of station and physical plant

d. Detailed lists of actual policies and procedures of individual stations

e. Specifics describing student personnel as it relates to academic major, year in college, year in college as compared with position, and time actually spent working at station

f. The personnel section confines itself to examining gross numbers reflecting those involved and station groupings

2. Due to the size and complexity of radio operations it is impossible to collect all data within the confines of a fairly concise questionnaire. To have increased the size of the questionnaire would have decreased the amount of responses.

3. There are actually two distinctive categories of college and university stations identifiable at the outset of this study. NPR affiliates all meet certain specific minimum standards of personnel, operating times, budget, and operating power. They are considered together. The non-NPR affiliates have no formal restrictions on them as to budget, personnel, operating power, and broadcasting times. These stations are considered statistically in one category and two subcategories: 10 watt stations (10WS) and stations whose operating power is greater than 10 watts (Gr10WS).

DISTRIBUTION OF THE INSTRUMENT

After a pilot study was conducted at the 1982 Broadcast Education Association Annual Convention and refinements were made, the survey was sent out in April, 1982 and seven weeks was allowed for responses.

The survey was sent to 670 college and university stations throughout the United States. Of the 670 sent out, 268 (40%) were returned. Of these, 243 (90.7%) were completed adequately. The information contained was entered into a Honeywell Level 66 Computer housed on the campus of Indiana University of Pennsylvania (IUP) for analyses utilizing the SPSS program which generated descriptive data as they related to mean, median, mode, and range of specific items and sections (see Leidman & Lamberski, 1986 for a detail methodology presentation).

Findings and Conclusions

The all inclusive findings of the survey are too lengthy to fully report within the confines of this particular discussion (see Leidman, 1985). However, some of the major areas of interest including financing, technical personnel, staffing operating hours, and programming are discussed herein.

All statistics and descriptions contained here have been derived from the 243 completed questionnaires. NPR responses equaled 51. They represent

7.9% of the population and 21% of the replies. Non-NPR stations participating numbered 192, or 28.65%, of the population, or 79% of the respondents. Of the 192 non-NPR stations, 42 were 10 watt stations. They represent 6.27% of the population, 17.28% of those replying, and 23% of the non-NPR stations participating in this study. Non-NPR stations with power greater than 10 watts numbered 150 representing 22.38% of the population and 61.72% of the respondents, and 78% of non-NPR stations participating in this study.

Both the 10 watt stations as well as those with power greater than 10 watts are included in the general category of non-NPR stations as well as the component parts.

In summary, for the purposes of this section, the following will equal the relative frequencies (percentages) of 100%:

N = 243--All stations

N = 51--NPR stations

N = 192--All non-NPR stations

N = 150--Non-NPR stations with power greater than 10 watts

N = 42--Non-NPR 10 watt stations

COLLEGE AND UNIVERSITY FINANCING--SUMMARY

This section examined the gross amount of money reported by the 219 stations responding to this section. It also considered the sources of station funding and the percentages derived from specific sources.

A limitation to this section concerned itself with how stations interpreted what "operating budget" involved. There is some question as to whether or not managers included such line items as student Federal Work Study money, release time salary equivalent for professionals, and standing costs such as rent, electricity, etc.

The total amount reported by the college and university stations responding to the item regarding operating budgets was $22,383,990. The range was from $600 to $1.5 million with the average for NPR standing at $345,228, for Gr10WS at $42,462, and for 10WS at $10,649.

Although stations tend to receive funding from any number of different sources, when examining this variable as a whole, indications are that less than 50% receive any substantial amount from any particular source with the exception of NPR and their receiving 50% of funding from general college funds.

Findings indicate that with the exceptions of donations and grants, college and university station groupings receive some of their financing from a combination of the following sources. These include: general college funds, funds administered by a particular school or department, student funds (activity fees, etc.), and other sources such as underwriters. Though a category for endowment was included in the original list of possible funding sources only two schools received any funding in this way.

NPR-affiliated stations reported receiving smaller amounts of monies from schools, departments and student funds than do the non-NPR group. This is also true of student funds. However, they do receive more of their funding from grants and donations. Only 8% of the non-NPR stations receive grant money and 40% receive donations. However, 74% and 85% of the NPR stations receive these funds, respectively.

Almost 50% of the non-NPR stations derive an average of 77% of their funding from student-generated funds vs. only about 66% of the NPR stations that do so.

While 83% of the NPR stations receive about 50% of their monies from general operating funds, 47% of the non-NPR facilities receive money in this way. However, the amount of this funding for those non-NPR stations averages 67%.

While almost 27% of non-NPR stations report receiving 6% of their funding from funds administered by specific schools or departments, only 14% of the NPR affiliates do so. These stations receive approximately one-half of their funding in this way.

Other sources of income such as underwriters were reported by 80 stations (36.5%). When breaking down recipients, one observes that 35 (74.5%) of the NPR stations receive "other" funding as compared with 45 (26.1%) of those who are not. Somewhat surprisingly, the 10 watt stations reported the highest mean percentage in this category, however, only six 10 watt stations total reported funding of this type. Also, the 10 watt stations showed a considerable number (23) receiving a majority (78%) of their funding from student funds.

It is important to note that most stations (approximately 85%) received funding from at least two sources. None received funding from all sources.

STATION FUNDING--CONCLUSION

Although percentages can be deceiving, dollar amounts are real. Therefore, even though a 10 watt station might receive 100% of its operating budget through underwriters, this amount might only be $1,000. In the interest of greater participation, this study chose not to delve into the exact dollar amounts generated by particular sources. However, certain things are evident.

A higher percentage of NPR stations receive a greater amount of their money from general college funds. The non-NPR stations show a closer fiscal relationship to school or department funds. That this is so would seem to emphasize the fact that colleges and universities provide a substantial amount of backing to high expense NPR operations. Furthermore, schools and departments hold the purse strings for many of the other stations. This can be interpreted to mean that closer academic and educational ties exist between the non-NPR stations and curriculum.

The actual range of operating budgets is in itself somewhat astounding. To even begin to compare a facility that subsists on $600 per year with one that has the resources of $1.5 million can provide seems ludicrous. Yet both of these facilities work under the same set of FCC guidelines.

Although it is understood that NPR stations must have a minimum budget of $100,000 per year in order to remain affiliated, the fact that their average budget is $345,000 is indicative of the kind of support these stations receive. Comparing this with the average 10 watt station with a budget of some $10,000 cannot help but lead one to certain conclusions about availability of resources, equipment, and personnel. NPR stations have all three.

It can be argued that institutions which heavily fund NPR stations do so out of a sense of mission related to community service. Yet, the 10 watt stations also supply such service, or at least try to do so.

In the world of college and university radio there are stations with greater than 10 watts of power that have substantial operating budgets. The $42,000 average reported by these stations carries with it availability of broadcasting resources. Yet, the mode and median of $20,000 are probably more accurate in this case. At least in terms of finances, it can be concluded that the larger non-NPR stations are viable.

Finally, it would appear that college and university stations do receive at least some money from a variety of different sources. They take it where it can be found. The level of commitment toward college and university radio, based on interest and availability of funds, varies from institution to institution. The fact remains, however, that college and university stations do receive money.

TECHNICAL HELP--SUMMARY

Of 98%, or 239 stations reporting, 197 (45%) reported having full-time technicians vs. 132 (55%) which had some type of part-time technical help. Of NPR stations, 88% had full-time technicians as compared with 33% for the non-NPR stations. Only 16.7 (7) 10 watt stations reported employing a full-time technician. Furthermore, 229 (96%) of all stations answered that they did have access to someone with a First Class FCC license.

TECHNICAL HELP--CONCLUSION

Once again, it appears that 10 watt stations are definitely on the bottom of the college and university radio pile. Their lack of full-time technical help is evident. This is just another indication of the problems confronting such operations. NPR stations are well established in this area and G10Ws, although not having complete technical help, at least show that there is some attention being paid to this phase of operations.

ACTUAL STAFFING OF THE COLLEGE AND UNIVERSITY STATION

There were several areas of staffing analyzed by this research. They ranged from staff totals and students involved in station operations to which students were paid, received academic credit, or were volunteers.

The gross number of individuals involved in the operations of the 236 stations reporting totaled 11,886. Of these, 1,388 were associated with NPR stations as compare with 10,498 for the non-NPR. Furthermore, the average for the non-NPR station was much higher, 56 people vs. 29 for the NPR stations.

Stations definitively reporting student involvement (SRSI) numbered 225. This measurement shows some 9,540 students involved. In NPR stations there were 767 vs. 8,772 in non-NPR stations. The percentages of student involvement are much higher in non-NPR stations than in NPR stations. Also, indications that 10 watt stations are the most dependent on student help is apparent.

STAFFING CONCLUSION

Volunteerism seems to be a backbone of non-NPR stations. Most (88%) of the people involved receive no remuneration. This is to be expected within an educational setting, yet the dependence of any organization on such a high level of young volunteers cannot help but have a marked effect on the organization's performance.

College and university radio stations strive for a competitive "professional" sound. However, indications are that realization of this goal is made more difficult because of staffing patterns.

COLLEGE AND UNIVERSITY OPERATING HOURS--SUMMARY

College and university stations generally broadcast for long hours during the academic year. NPR stations, bound by contractual agreement with a network average between 18 and 21 hours per day (hpd) year round. The findings bear this out. This is not the case with non-NPR college and university stations. Two hundred and forty-one stations reported on operating hours.

There is a change apparent in operating hours among non-NPR stations. While they average 18 hours per day during weekdays when classes are in session, the mode reflects an actual increase of stations broadcasting around the clock on weekends, 40 stations for weekday operations versus 48 stations on weekends. However, the actual average decreases by approximately 1 hpd.

Non-NPR stations show some tendency to close down in the summer months. Sixteen (9%) of the Gr10WS do so as compared with 48% (20) of the 10 watt stations. However, those remaining on the air average about 16 hpd.

During winter and spring recesses the non-NPR stations also close down at an even higher rate than they do in the summer. Thirty-eight percent of the 10 watt stations cease operations and 33 (22%) of the Gr10WS do so. However, those continuing operating average close to 18 hpd.

OPERATING HOURS--CONCLUSION

If broadcast hours can in some way be equated with level of commitment to community service and professionalism, it might be concluded that at least during the months when school is in session all college and university stations show a high degree of both.

NPR operations are not an issue here. They operate 365 days per year. The consistency with which the non-NPR stations broadcast reflect an essential difference between them and the NPR group. Either through choice or necessity born of inadequacies of whatever sort many average college and university stations leave the airwaves when school closes. This fact can lead one to the conclusion that such stations have yet to completely come of age in regard to realization of fully professional schedules.

PROGRAMMING--SUMMARY

College and university radio programming is not standardized. There is a wide range of programming types to be heard throughout the cross section of American college stations.

Of 229 respondents, 179 (78%) reported that they did have a specific sound or format. These covered the range of music from jazz to AOR to free form to fine arts.

Unlike past studies, this one found that although classical music is still carried by many (167) college and university stations, jazz, with 170, has surpassed it in popularity. However, in terms of gross hours per week (hpw), indications are that rock supersedes both jazz and classical. Yet, the broadcasting of rock was reported by only 147 stations as compared with classical and jazz. Indications are that those stations which do air rock devote a great deal of time to it. For the purposes of this summary all rock types have been grouped together, although within the study rock subgroups such as Progressive, AOR, Heavy Metal, New Wave, Punk, Retrospective, and Top 40 were examined. Very few (10) NPR stations broadcast any rock. This represents only 21% as compared with 78% of the non-NPR stations. No NPR station reported playing any heavy metal or punk rock.

Other types of music on college and university airwaves include blues, country and western, bluegrass, Broadway, MOR, adult contemporary, Christian religious, reggae, and urban contemporary. With the exceptions of MOR-adult contemporary and Christian religious, the other types of music average under 10 hpw in each category throughout the station subgrouping types.

The MOR-adult contemporary statistics indicate that although comparatively few (49) play this music, those that do average between 19 and 28 hpd with an overall mean of 26 hpw. The 10 watt stations play the least.

Only one NPR station reported broadcasting any Christian religious music. Sixty-three of the non-NPR stations do so averaging 24 hpw with a range from 1 to 168 hpw. This indicates that wholly Christian religious college and university stations exist. Format types reported support this indication.

In regard to news-public affairs programming, 208 (93.7%) of all stations air such programming in varying amounts ranging from an average 10 hpw for 10 watt stations to 12 hpw for larger non-NPR stations to 30 for NPR affiliates. Included in this category are news, sports, public affairs, and talk.

Some type of specific news was reported as being broadcast by 179 (80.6%) of the respondents. NPR stations were again first with an average of 22 hpw for 41 (87.2%) of their affiliates as compared with 6 hpw for the 138 (79%) for the non-NPR stations. The other subcategories of new-public affairs were similarly weighted.

PROGRAMMING--CONCLUSION

It is evident from the findings of this study that substantial changes within the realm of college and university program fare have taken place. However, it would be irresponsible and inaccurate to draw universal conclusions to an absolute nature. These findings may be judged to be indicative rather than chiseled in marble.

It would appear that college and university stations in their programming are moving away from their traditional role as the bastion for preservation of classical music. Programming is much more mainstreamed, and so broadens the base of appeal, not only for the listener but also for those involved with the actual broadcasting. In the case of most non-NPR stations this means that students, like most young adults, exhibit taste in music which reflects the times. For the early 1980s, the most popular genre of music heard on the air is some type of rock. This thought is easily supported by turning the radio dial down its length as well as checking best-selling record lists in Billboard, Variety, etc.

The rock element is undeniable. Several college and university stations are solely rock-oriented in content. This development represents a great change from previous times. The trend will most likely continue but probably never totally dominate the college and university radio scene. Current music will always be available through commercial outlets. This may not be true for either jazz or classical.

The upsurgence of jazz may be judged as resulting from a search for the least offensive common denominator. Very few people are offended by jazz. Many are devotees. But jazz commercial stations have yet to appear in any numbers, therefore, jazz on noncommercial radio offers a real alternative.

Young adults prefer to listen and broadcast their own type of music, but jazz proves to be a palatable alternative for them as well. Classical music listeners generally find jazz appealing. Supporting this view is the fact that the classical music commercial station WGMS-FM, Washington, D.C., features jazz every Saturday evening. The program is very well-received by its listeners.

Thus, for the college and university station in quest of a compromise, jazz works. NPR stations continue to carry a lot of classical music but they, too, have jazz.

Those stations which air Christian-religious or Christian-contemporary music are, in all cases, connected with a religiously-based institution. This interdependence is not only absolute but it is also exclusionary. If such institutions continue to find that it is in their interest and that of their select listenership to broadcast this type of programming, they will do so and will remain a minority factor in the college radio picture.

The seeming lack of news-public affairs-oriented programming is apparent. Does noncommercial college and university radio operate in the public interest? Whatever one's particular interpretation of same, the answer cannot be final.

That sector of college and university radio which has the greatest resources produces the most public affairs-news programming. NPR stations cover the issues and looks at the world more than most.

It is easy to criticize non-NPR college and university stations for not airing more news and public affairs. It is also easy to accuse these facilities of not operating in the public interest. Yet, without adequate backing and resources, realization of this directed charge becomes very difficult, if not impossible.

College and university programming has undergone changes. There continue to be many stations using a block programming technique which tries to appeal to many audiences but there are also many which commit themselves to a specific format.

One basic question that remains is that concerning itself with mainstreaming noncommercial radio. Is it a good idea to have this sector of radio also appeal to the majority or should college and university radio still cater to the minority audience of its traditional appeal? The question has no single answer and this study would indicate that college radio itself has yet to decide in a unified fashion.

Directions

While in the course of this study certain other related projects which could be of use to the field of college-and university-affiliated radio became apparent.

Some are listed below:

1. To survey the 10 watt stations existing in 1983 and ascertain how many made the transition, joined cable systems, or ceased operation altogether

2. To examine overall college operating budgets and learn what percentage is appropriated to FM radio operations

3. A study to ascertain the following: Do college and university stations feel the need to compete with commercial stations? Do they now program in this direction?

Certain other interesting trends also surfaced. One in particular deals with the basic character of noncommercial radio, specifically the amount of rock and roll of all types currently being broadcast.

If the statistics of this study are truly indicative then they show a kind of "loss of identity" for traditional college and university stations. Furthermore, it would seem that such facilities are programming competitively with commercial stations. It is possible that this will be the direction in the future for all but those select few NPR stations.

Another disturbing result of the programming reported by college and university stations concerned the small amounts of news-public affairs programming produced. Granted that such programming is difficult to create and sustain at a high level. However, the entertainment-oriented radio which was reported by most stations comprises only part of the mission originally set forth by the FCC when noncommercial radio was created.

It seems that the issues surrounding college and university stations as training grounds for future broadcasters and the predominance of rock on many stations cause a conflict of purpose. If an ultimate mission of a college and university station is to compete and train competitors for the world of broadcasting, does it not seem that many are losing an excellent opportunity to improve the caliber of offerings on the airwaves not only for the present but for the future as well. Yet there is no question that college- and university-affiliated radio is a viable, dynamic entity in the broadcasting picture today.

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A METHODOLOGY IN STUDYING NONCOMMERCIAL FM RADIO STATIONS -- A CASE STUDY

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A METHODOLOGY IN STUDYING NONCOMMERCIAL FM RADIO STATIONS -- A CASE STUDY

Abstract

The purpose of this undertaking was to examine the state of college- and university-affiliated noncommercial FM radio as it was today in the early-1980's. This was done by first examining the literature surrounding the background of noncommercial radio in order to develop a survey framework within which to work. The second and more immediate phase of this project involved securing data concerning certain phases of college and university radio operation and as a result gather new and up-to-date information relative to these organizations.

This research was national in scope. It was, therefore, necessary to construct a questionnaire and distribute it to all college and university stations nationwide which were identifiable through the 1982 Broadcasting Yearbook. In order to construct the seven-part questionnaire, an examination of needed information relative to noncommercial FM college and university radio was made. Additional information was gathered by interviews with people involved in the field. Before actually sending the questionnaire, it was examined and commented upon by a committee of noted researchers, sociologists involved in this type of research, and two noted broadcast educators. A pilot study was conducted at the 1983 BEA convention with follow-up among the participants.

Comments and criticisms of the instrument are presented in this paper along with the major findings.

A METHODOLOGY IN STUDYING NONCOMMERCIAL FM RADIO STATIONS -- A CASE STUDY

Historical Content

Noncommercial FM educational radio is a huge animal that exists in a world that does not really understand it.

All radio stations, or for that matter, any mass media operation, represent an extremely complex set of interrelationships using technology, talent, and human relationships. In order for any broadcast station to function effectively, it develops its own superstructure. Yet, college and university stations must operate within a larger superstructure.

There is a constant need to update the data in this area and yet, as the literature shows, this is not done regularly. The annual National Public Radio -- Corporation for Public Broadcasting reports only deal with their own, not with the whole college and university radio scene, as do other organizations such as the Broadcast Education Association.

Research has never had an important place in educational broadcasting. Very little has been done on educational broadcast facilities. This fact was examined by Avery (1978) who concluded that more research was needed to be done by academicians and broadcast research should be stressed in undergraduate curriculum.

Twenty years ago, the National Association of Educational Broadcasters conducted a thorough study of educational radio under the auspices of the Ford Foundation. Their published, The Hidden Medium, examined the then current state of noncommerical radio.

At approximately the same time, Rashidpour (1965) surveyed educational radio stations. Two problems emerged: lack of money and lack of personnel.

Presently, there is a great deal of information available about college and university noncommercial stations affiliated with NPR. However, there is a dearth of material on nonaffiliates. It would be useful to make some attempt to help remedy this situation. Unfortunately, the Broadcast Education Association (BEA) only keeps accurate records of its own membership. Although excellent, it is not nearly complete (Caldwell & Niven, 1981).

Based on the aforementioned studies, it would appear that the area dealing with college- and university-affiliated FM noncommercial radio is one that is always ripe for additional research. The field is always changing and enlarging. It is, in a word, dynamic.

Managing a college or university station is difficult. Most people involved have little or no formal background in management. New data for reference's purpose would also be helpful to aid in planning for the future.

The Purpose

The purpose of this paper is to present a methodological approach and resultant findings revealing the current state of college- and university-affiliated noncommercial FM radio in the United States.

The following areas of college and university radio were studied:

1. Basic description of the station as it pertains to enrollment of the institution housing the station, station operating power, licensee, age, number of other FM stations in the area, organizational memberships of the station, and unit affiliation;
2. Station funding as it pertains to operating budget and percentage

sources of the funding;

3. Organization and structure;

4. Personnel as it pertains to managers of college and university stations, technicians who maintain equipment, and overall professional, as well as, student staffing of facilities in terms of gross number;

5. Operating hours as it pertains to length of time college and university stations broadcast during various times of the year;

6. Programming as it pertains to specific formats reported, what is actually broadcast, availability of satellite technology; and

7. Station philosophy as it pertains to college and university operations in general.

Development of Instrumentation

Procedures

Before constructing the questionnaire, other area-related instruments, including the NAEB instruments were reviewed. Interviews and discussions were also conducted with various professionals in educational radio and sociology to make sure that the appropriate areas would be included for consideration. A preliminary questionnaire was developed and submitted to William McCavitt of Indiana University of Pennsylvania and also to a noted educational broadcaster, John M. Kittross of Temple University, as well as Donald Lueder and Willard Clouse of Vanderbilt University. Returned suggestions lead to a refining of the questionnaire.

A pilot study of this survey took place at the 1982 Annual Meeting of the Broadcast Education Association. Twenty college and university managers were present. Follow-up interviews took place and focused upon critism of the instrument in order to more fully refine the final questionnaire. A copy of the final questionnaire has been attached to this paper.

The questionnaire would be sent to all identified college and university stations increasing the probability of response and ultimately the confidence in results. Mailing to all identified stations also avoided possible sampling errors brought about by arbitrary sampling procedures. Simply, this survey research is treated as a descriptive study meant to "discover the distribution of certain traits or attributes" (Babbie, 1973, p. 58) of college FM radio. No value judgements are involved, only observations and summations.

The final questionnaire was printed and mailed to general managers of all noncommercial FM radio stations affiliated with colleges and universities in the 50 United States. They were asked to return the questionnaire within seven weeks. The population to receive the mailed questionnaire consisted of all noncommerical college and university stations as identified in Broadcasting Yearbook (1982) (N=670).

A self-addressed, stamped envelope was included to encourage participation. An introductory letter stated the purpose of the survey and the promise of a report upon completion of this project.

Two consent forms were also included. The first form granted permission to use any and all information provided within the narrative portion of the findings. The other consent form assured confidential use of material for statistical compilation purposes only.

Explanation of the Questionnaire

The purpose of the questionnaire was to gather data on college- and university-affiliated FM radio operations as stated in the purpose. The results were used in descriptive data analyses. As indicated, questions formulated were governed by the desired research questions and refined through extremely internal peer review.

Internal and external validity of the questionnaire was controlled in part by extensive professional reviews and through a controlled pilot test. Subsequent instrument revisions allowed for a strategy of open ended statements supported by an elaborate system of data encoding.

The instrument included six basic areas which, after the data was compiled, to provide an accurate description of the college and university radio stations. The questionnaire can be found in Appendix.

The term Faculty-Advisor-Manager (FAM) has been developed in order to cover all possible jurisdictions. This person may or may not be a member of college faculty. He or she may be a faculty advisor or a faculty manager or perhaps just a manager, or even a student manager. It was requested that the chief executive (FAM) of the station fill out the questionnaire.

Specific demographic questions profiling the FAM were included. Variables taken into consideration are age, sex, education, major fields of study, years in higher education, and academic status.

It was interesting to examine whether or not the FAM is tenured and whether or not this person is full time or nonacademic, etc. Other questions include those about length of time at institution and professional experience in radio and broadcasting. When compiled, this information provides opportunities for additional interpretation of the findings.

The questionnaire contains items asking for information about the station including enrollment, licensee, call letters, age of station, and power. It also requests information about population of listening area and some related information about FM radio in the station area. These are descriptive data important in the operation of all mass media operations. A question to identify NPR affiliates is included in order to isolate and develop this subcategory. Additional information on news service, programming sources, and station membership, would allow the development of comprehensive, inclusive lists of memberships and programming sources. Identification of parent division of source for station accountability was also requested.

Two pages of the questionnaire dealt with programming. The resulting information was used for program content analyses and broadcast operation. A music offering list was developed after consultation with musicologists and radio music directors. Questions also pertain to satellite reception-transmission capabilities.

The section on personnel examined such issues as number and classification of employees at the stations. The sections also examined technical backup personnel as a separate entity.

The funding section provided financial data on station expenditures and sources of the funding.

The last section of the questionnaire dealt with general policy and decision-making patterns and a statement of basic philosophy. Philosophy statements would be compiled and reported where consent allowed.

Data Analyses

The analyses of the data received from this survey were done at Indiana University of Pennsylvania (IUP) under the guidance of Mark Staszkiewicz, director of Institutional Research.

For initial as well as follow-up data analyses, the Statistical Package for the Social Science (SPSS) (Nie, 1975) was used. This package allowed subgrouping into defined factor lists. Given the wide range of variability in the data and unequal cell N's, the SPSS package is very accomodating to descriptive studies. In order to identify and focus upon certain trends and patterns, means, median, modes, and ranges were computed and interpreted.

The analyses of the subgroups, as well as that of all stations, is included where large ranges exist. In a particular case, such as the FAM profile, this was not necessary due to the consistency and similarity of received data.

The major questions are, for the most part, discussed and then illustrated within the confines of numerous tables. Although certain summations and tentative conclusions are reached in this study, the inclusion of summarized raw data provides the reader an opportunity to agree or disagree with them.

This straight-forward multivariate analyses and explanations presented section by section with accompanying tables provided the greatest efficiency in analyses and improved the effectiveness of interpretation. A limitation to the survey method was the differing levels of frequency response. Where response was limited, interpretation would not be final but would be noted as tentative.

Also, in order to maintain the integrity in the reporting of the findings, the Frequency of Response (FOR) was used for comparative purposes rather than _N._ This FOR or percentage of N was noted. The inclusion and exclusion of missing values are treated on an item-by-item basis.

As the completed surveys were received, the data was coded and entered on-line into a Honeywell file program known as BEDIT. BEDIT is essentially a prompting data entry program which, in this case, was tailored specifically to the needed variable list. An SPSS "run" program was written which entered the columned data formated by BEDIT. The efficiency of managing data input and analyses was thus greatly enhanced. SPSS was also conducive to the development of descriptive tables; these included items where the information was qualitative rather than quanitative. Examples of these include Format Types, Outside Programming Sources, Person to Whom FAM Responsible, and others.

Throughout the process of statistical analyses, an experienced research team from the Applied Research Laboratory, IUP, was also available for any needed assistance. The professional support helped insure that data interpretation would be relevant and accurate.

Overview of Results

Discussion of the findings focused upon the major elements of the methodological framework in the areas of station: (1) demographics; (2) funding; (3) organization and structure; (4) personnel; (5) operation; (6) programming; and (7) philosophy or mission. For a more detailed accounting of the findings, see Leidman and Lamberski (1986).

All findings have been derived from the 243 completed questionnaires. This represented a 36.3 response rate (670 were mailed out). NPR responses equaled 51; they represent 7.91% of the total population and 21% of the returned replies. Non-NPR stations participating numbered 192, or 28.65%, of the total population, or 79% of the respondents. Of the 192 non-NPR stations, 42 were 10 watt stations. They represent 6.27% of the population, 17.28% of those replying, and 23% of the non-NPR stations participating in this study. Non-NPR stations with power greater than 10 watts numbered 150, representing 22.38% of the population and 61.72% of the respondents.

Both the 10 watt stations, as well as those with power greater than 10 watts, are included in the general category of non-NPR stations and were given their own subheadings as well. This subdivision allowed for examination of trends among non-NPR stations as well as component parts.

For purposes of this paper, the major findings will be highlighted.

Highlighted Findings

The investigation examined data obtained from questionnaires sent to selected FM noncommercial stations. Initial analyses of demographic data indicated these stations could be clustered into three noncommercial groups. These groups can be demographically defined as:

1. National Public Radio (NPR) Affiliates;
2. Large Non-NPR Affiliates (over 10 watts); and
3. Small Non-NPR Affiliates (10 watts or under). This third group has been ordered by the FCC to be phased out.

All NPR stations are "Corporation for Public Broadcasting Qualified" meaning they meet certain financial, facility and personnel requirements which include:

1. Daily schedules of at least 18 hours of programming per day, 365 days per year;
2. A minimum of 5 full-time professional staff;
3. An adequate (two studio) physical plant; and
4. Budget of at least $100,000 annually.

These criteria place NPR stations at a distinctively different level of operations and planning than most other college and university FM stations. The NPR status not only identifies a station whose resources and commitment are superior to most FM noncommercial stations, but also administratively indicates continued support in order to maintain NPR affiliation.

Given this identified demographic clustering, the following rank order summary of the major findings can be presented.

I. BUDGET

- a. A majority of stations are expected to operate fully functional broadcast operations on a small financial base.
- b. Stations, in general, suffer from a consistant level of financial support.
- c. Sources of budgetary support vary by demographic group and inconsistency over time.
- d. NPR Stations have a superior budgetary base as compared to other demographic groups.
- e. Generally, stations suffer from inadequate commitment from parent institutions.

II. STATION ORGANIZATION AND STAFFING (exclusive of NPR affiliated stations)

- a. Stations have inadequate technical support.
- b. Time allotted to professional station managers is generally inadequate or split with other institutional responsibilities. Manager's time devoted to station operations appears consistently inadequate.
- c. Most stations indicate a heavy dependence upon volunteer help to operate the station.
- d. There is a consistent expectation that the station will maintain a "professional sound" even given the reality of a mostly non-profesional volunteer student staff.
- e. Most stations have a lack of adequate compensation or reward system for student staff.

III. PROGRAMMING

a. Format varies widely by demographic group and institutional expectations. At best, the noncommercial spectrum is inconsistent in an identifiable format.

b. Programming covers the full gambit of sound, from classical to jazz to rock, etc.

c. Data reveals inconsistent operating times during "normal" programming periods. Particular concern was identified given the inconsistent operating time between session recesses for FM stations affilitated with academic institutions.

IV. STATION PHILOSOPHIES

a. Survey data indicates little consistent thought or conceptualization.

b. Station philosophy varies depending upon station market thrust and selected format.

In summary, the findings point to vast yet specific differences for FM noncommerical stations. These differences are clearly identifiable between the three demographically defined groups. Within group variablity is highly dependent upon the parent institution and NPR affiliation.

Recommendations

There are positive and negative aspects of this instrument. Although there is much to be said for some questions of an open-ended variety, it renders more difficult the task of coding and entering such data into a computer program. In retrospect, it probably would have been more efficient to have designed a questionnaire in which there would be an object list of alternative responses. However, this possibly would have distorted the results through a bias built in by suggested answers printed on the questionaire. As it was, the respondents were free to fill in the questionnarie with more exact answers as it suited them. Other recommendations would include:

1. Shortening the questionnaire by listing alternatives or eliminating less productive items. Or, having an initial mailing with a second follow through mailing thus spreading the requested information over time.

2. Develop a follow-up procedure where, depending upon item responses, a selected sample of respondents would be contacted for in-depth telephone discussion and elaboration.

3. Given the identified three separate respondents, develop questions unique to those respective three areas which provide more in-depth explanation.

4. Develop an incentive system and/or check system to make sure the senior administrator fills out or verifies the reported data.

5. Provide a list of terms either before the start of the questionnaire or define terms within item stems or listed alternative responses. This is particularly important in collecting data on policies and procedures, and personnel.

6. Convert some of the categorical, open-ended items to scaled indices.

This would be particularly possible given the known pattern of responses from this study.

7. Visually improve the instrument through layout and design to increase respondent particiaption and motivation.

8. Develop visual questionnaire responses. For example: a time grid would have aided in the collection of music type and hours broadcast.

9. Given the pattern of responses from the initial survey, develop a branching strategy within the questionnaire so that not all items need be responded to depending upon primary responses.

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APPENDIX
Survey Instrument

The purpose of this exercise is to gather data on noncommercial FM radio stations affiliated with colleges and universities in the United States. Results will be used in a descriptive analysis of college radio in the 1980s.

Faculty-Advisor-Manager (FAM) Information (If more than one FAM is employed, please have chief executive fill this section out.)

Age (check one)

Less than 30
31-35
36-40
41-45
46-50
51-55
56-60
61-65

Education (circle highest received)

BA, BS
MA, MS
MFA, MBA, ABD
PhD, EdD
DA, JD

__________________field of most recent studies (last degree)

Where was the highest degree earned?_____________________

Sex_______

Professional years of involvement in higher education:

0 1 2 3 4 5 6 7 8 9 10 or more

Tenured? Yes No

If no: Full-time Regular Tenure-track

or

Part-time Non-academic

(Please circle one of the above)

How long have you been with your institution?_____________

How long have you been in the FAM position?_______________

Previous to your present post, how many years have you professionally worked in radio? Full-time Part-time

Previously, what was the highest professional broadcasting job you ever held?____

APPENDIX
Survey Instrument

Demographic Information

University or college?______ Overall enrollment?____________

Who is the station licensee?________________________________

Call letters____

Year of first license____

Dial position____

Licensed power____

Effective radiated power_____________________________________

Number of potential listeners in your area (community and university combined)_____________________________________

Description of community (rural, urban, suburban)___________

Number of FM stations in your market_______________________

Number of other college- or university-affiliated stations (not attached to your institution) in your market________

Are you a National Public Radio affiliate?__________________

News affiliation (AP, UPI, Mutual, etc.)____________________

Programming affiliation (Texaco, Metropolitan, Longhorn, RKO, WFMT)--List all applicable__________________________

____

Station memberships (NAB, NFCB, IBS, etc.)__________________

To what academic unit (department or school) if any, is your station attached?_____________________________
If none, please explain:_____________________________________

____

____

APPENDIX
Survey Instrument

Programming (Please include as much detail as possible)

Daily operating hours (example 8 a.m.-2 a.m.)________________

Academic Year

Weekdays (Monday-Friday)________________________________

Weekends (Saturday-Sunday)______________________________

Holidays when school is in session_________________________

Holidays (such as Labor Day) when school is not in session)____________________________________

__ Check here if the above is true all year round and please go on to next section.

Winter and Spring Break

Weekdays____

Weekends____

Holidays (example: Christmas Day)___________________________

Summers

Weekdays____

Weekends____

Holidays (example: July 4th)_______________________________

Does your station close for the summer?____________________

If so, when (approximately)_______________________________

When do you resume operation?___________________________

Does your station have satellite reception equipment?	Yes	No
Does your station have satellite transmission equipment?	Yes	No

What is the title of the person(s) who approve specific programs or major programming changes?_______________________________

Does the station have a distinctive format or "sound"? (Please specify if "yes.")	Yes	No

APPENDIX
Survey Instrument

Types of Programming During Normal (Academic School Year) Hours of Operation

	Total hours per week	When (M-F, 5-7 p.m.)
Music		
Classical	________	________
Jazz	________	________
Blues	________	________
Country & Western	________	________
Bluegrass	________	________
Folk	________	________
Broadway	________	________
MOR	________	________
Adult Contemporary	________	________
Christian Religious	________	________
Disco	________	________
Reggae	________	________
Progressive Rock	________	________
AOR	________	________
Heavy Metal	________	________
New Wave	________	________
Punk	________	________
Retrospective rock	________	________
Top 40	________	________
News	________	________
Sports	________	________
Public Affairs	________	________
Drama	________	________
Talk	________	________
Classroom (instructional)	________	________
Religious (ex. Sunday) morning church hour)	________	________
Other (please specify)		

____

____

How much of your programming is generated by outside sources? (Ex. Newsweek FM or Captured Live)? ________hours per wk.

Please name sources and shows:

Sources	Shows

APPENDIX
Survey Instrument

Personnel

1. How many full-time, paid technicians does your station have?________________

2. If none, who maintains equipment?________________

3. Who possesses an FCC 1st Class or General License and signs technical logs?________________

4. How many people (both non-student, professional and students) make up your total staff for the station?________________

5. How many students work at your station per semester?__Full-time:________Part-time:________

6. How many (nonprofessional) students receive monetary compensation?________________

7. What positions?________________

8. How many students receive academic credit for working at the station?________________

9. What position do they hold?________________

10. Is it possible for a student to receive both credit and money for working at the station?________________

11. If yes, under what circumstances?________________

12. Approximately how many students work in a purely unpaid voluntary capactiy at the station?________________

13. What positions are these?________________

APPENDIX
Survey Instrument

Funding

What is the station's operating budget?____________________

From where do the operating monies come?
(Please express in percentages)

	Percentage
Specific general college or university funds	________
General college funds as administered by academic department or school	________
Student funds (activity fees, etc.)	________
Endowment	________
Grants (monies received through specific grant applications)	________
Donations (telethons, raffles, etc.)	________

Other sources:____

____

Policies and Procedures

1. What is the title of the person who manages the radio station?________________________________

2. Is this person a paid professional? Yes No

3. What percentage of the total contractual commitment of of the manager's time is devoted to the radio station (i.e., release time, load reduction)?________________

   If students are integrally involved, what is the student chain of command?________________________

4. To whom is the student leader directly responsible?

   ____

5. To whom is the FAM directly accountable?______________

   ____

6. Do written policies and procedures on station operation exist? Yes No

7. Please make a statement reflecting the basic philosophy of the radio station with which you are associated.

Effects of Selected Filmic Coding Elements of TV on the Development of the Euclidean Concepts of Horizontality and Verticality in Adolescents

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Investigation of the function and effects of selected filmic coding elements of television in learning and employment of those filmic coding elements in exploring the presence and development in adolescent high school students of spatial skill involving concepts of horizontality and verticality were the two major objectives of this study. The structure of the study combined approaches established by G. Salomon in the area of filmic coding elements and L. Liben in her work with Piagetian spatial concepts.

The inquiry was concerned with the differential role of media's symbol systems in the acquisition of knowledge and in the way these symbol systems can function as cultivators of mental skills. The particular area of knowledge pertained to the Euclidean space concepts of horizontality and verticality which involve the mental ability of spatial orientation.

Rationale

Based on the general premise that the symbol system is the most essential attribute relating the two "systems" of media and cognitions, Salomon argues,

> "symbol systems address themselves to different aspects of the world, and that some systems render specific aspects better than others ... Symbol systems vary as to the cognitive systems they address, and given a particular content, person, and task, the information they carry requires different amounts of mental recoding and elaboration. Thus the better the correspondence between the way information is presented, the less recoding is needed and the easier is the communication" (Salomon, 1979,p. 86).

To learn how media's symbol systems can be made to affect cognition under specific favorable conditions coding elements of media's symbol systems were used to activate, short-circuit or supplant processes for various types of learners. Activation stimulates or calls into action skills with which a learner has an initial acquaintance. In short-circuiting the coding elements provide ready-made results for the skill, while in supplantation the entire skill process is modeled. Coding elements that activate skills facilitate skill mastery in already skillful learners; coding elements that overtly model (supplant) skills facilitate skill-mastery in initially unskilled learners.

In dealing with learning tasks and cultivating mental skill mastery in the area of spatial relations film and television contain in their symbol systems specific codes to represent relatively unique transformations in space and time (e.g., slow motion, the zoom of a camera, rotations, split screen, and generated line cues). These coding elements were used to present the Euclidean space concepts of horizontality and verticality to high school adolescents.

Although Piaget and Inhelder (1956) maintained that a Euclidean spatial system is typically established by late childhood, other research found that children from nursery school through the eleventh grade (only girls were included from ninth to eleventh grade) and many college students were unsuccessful on horizontal water-level tasks (Thomas, Jamison and Hummel, 1973; Willemsen and Reynolds, 1973; Thomas and Jamison, 1975; and Harris, Hanley and Best, 1975). Verticality tasks (drawing trees and houses on hills with various degrees of incline) were introduced in Liben's study (1978). Working with seniors in high school, Liben found a sex-related difference to be present with both tasks of verticality and horizontality. Evidence indicated that imperfect performances by males and females showed no significant difference in number or type of task errors, nor in scores on field dependence/independence (EFT) and spatial orientation (Guilford-Zimmerman) measures. Performance on the Piagetian spatial tasks were significantly correlated with performance on the EFT in both sexes. In general males performed significantly better than females.

This study attempted to ascertain whether the filmic coding elements of split screen, slow motion, generated line cues, the zoom of a camera and rotation could aid in the development of the Euclidean spatial concepts of horizontality and verticality and the skill mastery of spatial orientation in adolescents.

Questions specifically addressed were

1. Would the type of filmic coding elements used in presenting Euclidean spatial concepts significantly affect the mean score of high school adolescents on a test based on those concepts;

2. For learners who have similar levels of understanding would the type of filmic coding element used in presenting Euclidean spatial concepts significantly affect the mean score on a test of those concepts given prior to and following the presentation;

3. Would there be a significant difference in the mean score of high school adolescent males and females on a test of Euclidean spatial concepts following the viewing of a television tape using selected filmic coding elements;

4. Following the viewing of a television tape using selected filmic coding elements would there be a significant difference in the mean score of high school adolescent ninth-graders and high school adolescent twelth-graders on a test of Euclidean spatial concepts;

5. Would the viewing of television tapes using selected filmic coding elements to provide training on Euclidean spatial concepts significantly affect the mean score of high school adolescents on the Gilford-Zimmerman Aptitude Survey, Part V Spatial Orientation?

Procedure

Two-hundred-forty randomly selected subjects for the study were placed in four groups composed of fifteen male and fifteen female freshman and senior adolescents. They were all from one four-year north-central Kansas public high school of about 1025 students.

They were all pre-tested for mastery level of the concepts of horizontality and verticality. The horizontal test involved drawing in the water level of half filled cup outlines positioned at various degrees of tilt. The vertical concept required the subject to draw trees on hills with various degrees of slope and to draw bulbs hanging from wires in trailers parked on hills with various degrees of incline. The Group Embedded Figures Test (GEFT) and the Guilford-Zimmerman Aptitude Survey-Part V Spatial Orientation were administered to all subjects before treatment.

A repeated measures, 4x2x2x2 factoral design, employing two MANOVAs was used. The factors were the two sexes, the two high school grade levels of freshman and senior, high and low groups of EFT scores, four experimental groups and pre/post tests. There were three treatment groups and a control group. The treatment conditions were those of activation, short-circuiting and supplantation used by Salomon (1974b). The repeated measures were the tests of horizontality, verticality and Part V Spatial Orientation of the Guilford-Zimmerman Aptitude Survey. The horizontal and vertical measures were used to reflect knowledge of those concepts and determine if any gain in those concepts occurred following treatment. The Spatial Orientation section of the GZAS was used to indicate if any mental skill development in the area of spatial relations occurred following treatment.

Tests and treatment were conducted on two consecutive days. On the first day all subjects were tested for knowledge of the concepts of horizontality and verticality. The GEFT and Part V of the GZAS were also administered. On the second day each group viewed one of four television presentations. Three television tapes were used to present examples of the invarient horizontality of liquid and the verticality of objects (people, trees and houses). One of each of the three processes of activation, short-circuiting and supplantation was employed in one of the tapes. The control group viewed a television tape of nature scenes set to music. Task booklets were used during the treatment portion. They were made up of outlines which corresponded to objects which appeared in the treatment tapes. At various places throughout the tapes the subjects were asked to perform a task which pertained to the concepts being demonstrated.

Using the SPSS^x language and operations, two MANOVAs were computed for the dependent variables of horizontality, verticality and spatial orientation. Means and standard deviations were computed for both pre and post test measures of horizontality, verticality andPart V of the GZAS for subjects in the supplantation, short-circuiting, activation and control groups. Phillais, Hotellings and Wilks multivaritate tests of significance were employed to determine if significant differences existed among the mean scores of the various groups. Univariate F-tests were carried out. All factors from four-way interactions to each individual factor of sex, grade level, treatment condition, and time of the first MANOVA and sex, EF scores, treatment condition, and pre and post test scores of the second MANOVA were examined. Graphs were drawn for all findings which revealed significant differences at the .05 or lower level of probability.

Results

Findings for the study came from the examination of two MANOVAs. The first one was based on data for the variables of sex, grade level, treatment group, and time. The second MANOVA included the independent variables of sex, EF scores, treatment groups and time. These two MANOVAs were computed for each of the dependent variables of horizontality, verticality and spatial orientation.

In determining whether the type of filmic coding elements used in presenting Euclidean spatial concepts would affect the performance of high school adolescents on tests based on those concepts the results of the MANOVA based on the interaction between Treatment Group x Time on the horizontal measures produced non-significant multivariate f-tests ($p<.198$). However the univariate F-test for the pre and post test measures on the curved cup outline was of borderline significance ($p<.057$). A look at the graph of the pre and post test results of the four experimental groups revealed that the supplantation and short-circuit groups appear to relfect the largest amount of change.

As for the vertical measures the multivariate $\underline{F}$ for Treatment X Time was significant ($\underline{p}<.043$). The univariate F-tests revealed a level of significance for the test with trees on hillsides was .253 but for the hanging bulb test the level of significance was .031. On viewing the graphs of the pre and posttest scores for the hanging bulb test it can be seen that the activation group achieved a change greater than twice that of the control group and that the short-circuit group increased their scores over four times that of the control group.

In addressing the question of the affect of filmic coding elements used in the presentation of Euclidean spatial concepts to learners of similar levels of understanding the multivariate $\underline{F}$ for the interaction of Treatment Group X EF scores X Time was non-significant ($\underline{p}<.687$) on the horizontal measures. Once again on the vertical measure the MANOVA using Sex X Group X EF scores X Time provided a four-way interaction having a multivariate $\underline{F}$ at the .017 level (Pillais, Hotellings and Wilks).

The univariate F-test was non-significant ($\underline{p}<.100$) for the difference on the drawing of trees on inclines but the univariate $\underline{F}$ for the difference on the drawing of bulbs hanging in trailers parked on inclines was significant ($\underline{p}<.026$). A look at the graphs of these findings for the bulb in trailer test reveal a consistent pattern of higher results for EF2 (high scores) group over those of the EF1 group. The level of performance by both EF1 and EF2 is not as high for females as for males.

Treatment Group X Time interaction for the multivariate test produced an $\underline{F}$ which was significant ($\underline{p}<.039$). The univariate F-test for the bulb in trailer measure was significant at the .025 level. The various treatment groups do not follow the same pattern for either the male or female or the two levels of EF. The short-circuit group shows the greatest gain from pre to posttest scores for both male groups. For the females, activation appears to be the most effective for the EF 1 group, but supplantation and short-circuit seem to be the most productive for the EF 2 group. This would not follow the work or findings of Salomon.

In checking on the role of sex in the performance of adolescent males and females on measures of verticality the test scores show a significant multivariate F-test ($\underline{p}<.001$). This substantiated the superior adolescent male performance over adolescent females found in past studies (Liben, 1978).

As for the role of grade level on the effect of filmic coding elements in working with concepts of verticality the multivariate test (Pillais) which deal with the average mean score for the two levels produced a non-significant $\underline{f}$ ($\underline{p}<.157$). The univariate F-test for the average mean score on the test of verticality for the bulb in trailer test was .075. The results of the MANOVA for the interaction of Time X Level revealed a significant univariate $\underline{F}$ ($p<.040$) for the mean scores on the bulb in trailer test. The graph of Level X Time pictures the greater increase made by seniors over that of the freshman on the vertical measure of the bulb in trailer.

The evidence of these two significant differences in sex and grade level for both the horizontal and vertical measures is most important to recall when interpertation of the other factors of the study are being reviewed.

A four-way interaction revealed by the first MANOVA on the horizontal measures produced a multivariate test of significance (Pillais) with a significant F ($p < .022$) for Sex X Group X Level X Time. The univariate F was non-significant for both the straight-sided cup outline ($p < .067$) and for the curve-sided cup outline ($p < .100$).

Examination of the graphs of the four-way interaction show the senior males had higher retest mean scores in all groups, scoring above freshman males and both freshman and senior females. Senior females scored consistently above the freshman female mean scores on the retest measures and surpassed the freshman male performance in the short-circuit and activation groups.

Senior girls narrowed the difference in the mean scores for males and females at the senior level in both the supplantation and activation groups. Freshman girls made gains on the repeated measures mean scores over freshman boys in the short-circuit and activation groups, but the freshmen boys showed larger gains over the freshman girls in the supplantation group. The freshman girls performed well below the senior boys in all groups.

As for the effect of the various treatments, the short-circuit and activation appeared most effective for senior boys. The freshman boys showed their greatest gain in the supplantation group. All three treatments proved beneficial for senior girls with activation and supplantation supplying the greatest rate of gain. Freshman females appeared to benefit most from the short-circuit tape.

The existence of this four-way interaction points out the difficultly of trying to understand the influence of the filmic coding elements in the light of the complexity of the sex and level related differences which have been noted.

Whether the use of filmic coding elements in providing training on horizontal and vertical tasks could have any effect on the skill mastery of spatial orientation was the final concern. Part V, Spatial Orientation, of the Guilford-Zimmerman Aptitude Survey was used to measure the mental ability of spatial orientation. Using sequential sums of squares, the first MANOVA revealed a four-way interaction of Sex X Group X Level X Time which produced a significant F at the .015 level.

These interactions were graphed holding various groups constant. In looking at the graphs of the senior and freshman levels of the males in the various treatment groups there is a similar pattern for the pre/posttest performance of senior males for the control, supplantation and activation groups. The short-circuit tape appears to have suppressed the change which occurred in the other three groups. The sequential sum of squares for the freshman males revealed the short-circuit treatment provided the greatest increase from the pre to posttest GZAS test scores. The pre/post gain for the activation group was also at a steeper rate than that of the control group. The males performed at higher levels and showed greater gains in the activation group than in the other experimental groups.

For the females, the graphs of the various experimental groups' sequential sum of squares showed the short-circuit and supplantaion groups increased at the most rapid rate for the senior subjects. The activation group for senior females showed little change from pre to post means. Freshman females registered their greatest pre/post GZSA score gain in the supplantation and activation groups. The short-circuit group provided little if any change in pre/post GZAS test scores for freshman female.

The F for the mean square of the interaction of Level X Time was significant at the .055 level. The senior' mean square was at a higher level than the freshman on both the pre and posttest administration of the GZAS.

Looking at the GZAS averages determined by use of sequential sums of squares it shows that sex has a significant F at the .004 level. A look at the graph shows the males scoring significantly higher then females. The graph showing the senior and freshman performances on the GZAS reveals significantly better scores by the seniors than the freshmen. Rather clear patterns of performance for sex and grade levels were established.

Implications

From the significant findings for individual factors and the various interactions it does appear that filmic coding elements do affect the development of the Euclidean concept of horizontality and verticality and did increase the mean scores on the Gilford-Zimmerman Aptitude Survey, Part V Spatial Orientation of high school freshman and senior adolescents.

Further investigation into the effects of selected filmic coding elements needs to be pursued keeping sex, grade level, concept understanding, treatment groups and time all as factors.

The shape of the container of the horizontal tasks does appear to have some effect on the mental processes of the subject, but results of the horizontal tasks did tend to form similar patterns and produce common significant findings.

For the vertical measures there were consistently different results indicating different aspects were being involved. The question of filmic coding elements widh might aid in development of understanding of each of those aspects of the concept of verticality would be open for investigation.

The presence and degree of development of the concepts of horizontality and verticality of freshman and senior adolescent subjects remains an area meeding further exploration. The work of Feldman (1980) might provide useful guidelines in studying the presence and development of the concepts.

Reduction of the difference in the mean score for various treatment groups between males and females needs to be followed up to fill in a vital part of the total picture.

The flat pre/post mean scores produced by the low EF groups indicate the need to look into this aspect of the study. Male and female adolescents who have scored in the lower EF group should be studied to see if any particular selected coding elements are more beneficial than others in helping them to master the horizontal and vertical concepts.

The significant findings based on the use of the Guilford-Zimmerman Aptitude Survey to reveal development of the mental skills of spatial orientation in adolescents through the use of selected filmic coding elements would be of import to those involved in education and those who have an interest in occupations which employ spatial orientation skills.

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Memphis State Regression
Computer-Managed Instruction Model

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Running Head: Memphis State Regression Model

Memphis State Regression Model

The advent of low cost microcomputer technology has aided the integration of computer assisted instruction (CAI) into the classroom. Typically, microcomputer software is planned as an attractive and adaptable alternative to learning from a textbook or programmed instruction book. Software created by instructional designers and sophisticated programmers has taken advantage of the microcomputer's graphics and sound capabilities, learner inputs, feedback, and record keeping abilities to produce attractive and versatile products.

Initially, the attributes of CAI suggested a medium capable of presenting instruction in a new manner. Recent research, however, has suggested that CAI may be no more effective than traditional textbooks once the novelty of the medium has disappeared (Kulik, Bangert, & Williams, 1983). Clark (1983) suggests a research strategy (and possible an instructional design strategy) that emphasizes the instructional methods as opposed to the individual medium.

Accordingly, our main assumption in this paper is that one of the computer's most powerful capabilities lies in adapting instruction to the learner. Adaptive methods typically found in the commercially available software use a weak form of adaptation that relegates instructional decisions such as speed, sequence, and difficulty to the learner. The learner control or internal control method is adaptive only to the extent the learners can make the necessary instructional management decisions (Johansen & Tennyson, 1983). In contrast to the learner control method is the program control method, often implemented in computer managed instruction (CMI), in which the designer controls the learning environment. Applications of CMI can range from simple branching based on the learner's response to decisions of the number or types of examples the learner needs, or when to exit the instruction. A principal criticism of the program-controlled method is the designer's ability to establish program control logic on criteria other than arbitrary and unvalidated rules (e.g., 80% correct; "3 misses in a row").

The purpose of this paper is to review three systematic adaptive instructional models used for computer-based curricular management. The types of adaptations included are (a) quantity of instructional support and incentives, (b) meaningfulness of problem-solving contexts, and (c) the density of narrative text. The first two models have been extensively examined in our prior research and evaluation studies. The third (context density) model is still in the developmental stage, and we will only report our preliminary findings in this paper.

Memphis State Regression Model

Individualized learning strategies (e.g., Keller, 1978; Bloom 1976) provide large amounts of instructional support, but typically rely on the subjective judgments of the learner to determine the amount of support required to achieve an objective. Frequently, these strategies result in high achievers selecting too much support and low achievers selecting too little support. Interest in this problem led to the development of the Memphis State Regression Model for systematically selecting the amount of instructional support an individual would need to achieve the objectives (Hansen, Ross, & Rakow, 1977). The initial application of this model was directed at a self-instructional unit covering 10 algebraic rules taught in an introductory college statistics course. A flow diagram summarizing the steps of the model is shown in Figure 1.

Insert Figure 1 about here

Implementation. The following is an explanation of each component step of the model. Step one was the selection of pretask (entry behaviors) variables to use as predictors of learner performance on the task. This predictive process is the foundation of the adaptive model with the basic rule of "if predicted performance is low, increase instructional support; if high, decrease instructional instructional support." The second step was the development of a predictive equation for each lesson (one per rule) from the results of a sample group. In the third step, the predicted scores were matched to instructional prescriptions specifying the number of examples the learner would require for each lesson. The prescriptions were incorporated into a computer program to generate a prescription for each learner. Prior to the treatment, the instructional booklets were arranged for each learner according to the computer generated prescription for each lesson. The lessons were then presented to the learner, and at the end of each lesson, a formative posttest was administered. Lesson posttest scores were used to make necessary refinements in the next lesson (i.e., adding or subtracting examples).

Evaluation of the model was performed in several studies. The first study (Hansen et al) consisted of five treatment groups. One adaptive treatment received individual prescriptions generated by the model. A second treatment, group-adaptive, received a prescription based on membership in a particular ability group. Two other treatments received either low (2 examples per rule) or high (10 examples per rule) levels of instructional support. The fifth group received instructional support that was varied nonadaptively. The results indicated the adaptive group performed significantly better than each of the other treatments. Of particular significance was the difference between the adaptive group and the high instructional support group. It was hypothesized the disadvantage of the high support group was due to inefficient use of instructional time. A second study (Ross & Rakow, 1980) comparing individualized-adaptive prescriptions to group-adaptive prescriptions and non-adaptive instruction also found the individualized-adaptive strategy to be significantly better than the group-adaptive and non-adaptive strategies.

Incentive Adaptations. An extension of the Memphis State Regression Model is the varying of incentives (Ross & Rakow, 1981). Incentives (normally 10 points per lesson) were divided so the lesson predicted to be most difficult was worth more points (e.g., 20 points) than the lesson predicted to be the least difficult (e.g., 0 points). The adaptive incentives strategy served to orient the students to make the most effective use of the materials. Significant learning gains were found for the adaptive incentive strategy over the standard incentive strategy (equal distribution of points).

The most powerful application of the model can be realized through a CAI system which updates the instructional prescriptions with each individual response or group of responses. These components create an "intelligent" system that varies the materials as learner's needs change during the course of instruction.

Context Models

A concern related to adapting how much is learned to individuals is to vary what is learned. The specific interest leading to the development of this latter model was the student's difficulty in solving math story problems (National Assessment of Education Progress, 1979). When the themes of the problems are abstract, unrealistic, or highly technical, the learner is faced with the difficult task of translating the meaning of the unfamiliar words and procedures, and then performing the necessary computations to arrive at the answer. The objective of this model was to adapt the problem contexts to the learner's interests to promote meaningful learning.

Implementation. The context model has been implemented in a PSI course (Ross, 1983) and on a CAI lesson (Anand, 1985). The first implementation involved the development of context examples related to the background of the learners, who were all educators, in a statistics course. Meaningful, educationally-related referents such as teachers, students, and homework were substituted for the abstract referents of "X", "Y", etc, (Ross, 1983). In other tests of the model, the context was personalized to the preferences and environment of the individual learners as obtained from questionnaire responses. This information was then stored as data in a computer program written in BASIC. Problem "templates" were stored within the program which could incorporate the learner's data to personalize the context. For example, if a student's favorite food was pizza and he had three friends, Billy, Joe, and Sam; the program would present a problem asking how he would divide the pizza between these friends and himself.

Results. In one study, Ross (1983) presented educators in a PSI course with instruction including context examples related to education (adaptive-education context). A second group received instruction with examples from medicine which substituted doctors, nurses, and patients for the referents. A third group received abstract examples using the referents of "X", "Y", "Event A", etc. The results indicated that the adaptive-education context group performed significantly better than the non-adaptive medical context group and the abstract context group. Nurses were used in a second study to determine if the results were due to the examples presented in the educational context, or to the adaptive-context strategy. The nurse sample performed best with medical-related contexts. These results were consistent with first study indicating that relatedness of context to student background comprised the critical factor for learning.

In a third study, Anand (1985) investigated the personalization of the context as an adaptive strategy with fifth and sixth-grade students in a math class. The first treatment consisted of abstract contexts using terms such as quantity, fluid, units and so on. The second treatment consisted of concrete context examples that used realistic hypothetical referents (e.g., Mrs. Smith, orange juice, etc.). The third treatment consisted of personalized context examples generated from the personal data collected prior to the instruction (e.g., best friends, favorite food, birthday, etc.). Results indicated that the personalized context group performed significantly better than one or both comparison groups on measures of conventional problem solving, transfer, formula recognition, and task attitudes.

Context Density Model

The third model, context density, focuses on systematic variations of narrative text as an adaptive strategy. Our interest in investigating this strategy is to tailor the context or text explanations to learner's needs, and to the attributes of the medium (specifically, computer versus print) to enhance comprehension and perception. Perception concerns the learner's attitude towards the instruction based on prior knowledge (Johansen & Tennyson, 1983).

The context density model builds on the support models previously described and other related studies (e.g., Rothen & Tennyson, 1978). The current model, however, differs from the support models which focus on the the more limited property of number of examples presented. Context density manifests itself in sentence or phrase length, degree of elaboration and redundancy, amount of contextual support, and linkages between major concepts. This model provides a means for restructuring the text by varying contextual density to meet individual needs without loss of comprehension as suggested by Johansen and Tennyson (1983). We have hypothesized that learners with a high learning aptitude or prior subject matter experience may be able to learn more efficiently from a less dense narrative without loss of comprehension. Similarly, learners with lower aptitude or no prior background may require a more dense narrative as contextual support for the information to be learned. This hypothesis is consistent with current schemata theories (Anderson, 1984; Rumelhart & Ortony, 1977) which suggest comprehension is facilitated by existing knowledge structures. Variations of context density as an adaptive strategy could possibly meet the varying needs of the learners.

A second area of interest with the context density model is the interaction with presentation mode--computer versus print. This interest in optimal use of instructional methodologies, not the delivery of the instruction, is consistent with Clark's (1983) proposal for research with the media. Are there possible interactions with the different context densities (i.e., high and low) and presentation mode due to delivery system constraints or attributes that will enhance or hinder comprehension? For example, what are the effects of the reduction of the CRT screen presentation to only 24 lines by 40 or 80 columns, or the lack of traditional cueing mechanisms such as bold and italic text, and underlining? Is there an expectation on the part of the learner to "see" less information on the CRT screen and more on a printed page, thus requiring more effort on the learner's part to comprehend the message presented on the CRT screen?

Implementation. In our initial study, two forms of instruction were developed using a section from a self-instruction statistics book developed by one of the authors. The low density version was developed according to a systematic algorithm for deleting extraneous and repetitious material in the high density text (original version). The stimulus material consisted of textbook and computer versions of the low and high density presentations. The computer version, written in Apple Superpilot, allowed the student to refer back to previous screens by pressing the B key.

Our pilot study consisted of print and computer presentation modes with either high density narrative, low density narrative, or learner control of narrative density. After collecting data on 35 subjects (approximately 6 per treatment), there appears to be a trend for learners in the computer mode to take more time in both the high- and low-density treatments. There is also a tendency for the subjects in the computer mode of the learner controlled treatment to select the high density narrative more often than subjects in the print mode. It appears that learners in the computer mode have less confidence when learning from information presented via a CRT screen.

Future investigations will use context density as an adaptive strategy to present high or low density narrative according to predicted learner needs generated with the multiple regression model used in the instructional support model. Applying the general rule for the support model, context density will be increased as the predicted score decreases; and context density will be decreased as the predicted score increases. Planned extensions include the refinement of the model to include varying degrees of context density instead of the two discrete levels now used.

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Figure Caption

Figure 1. Memphis State regression model

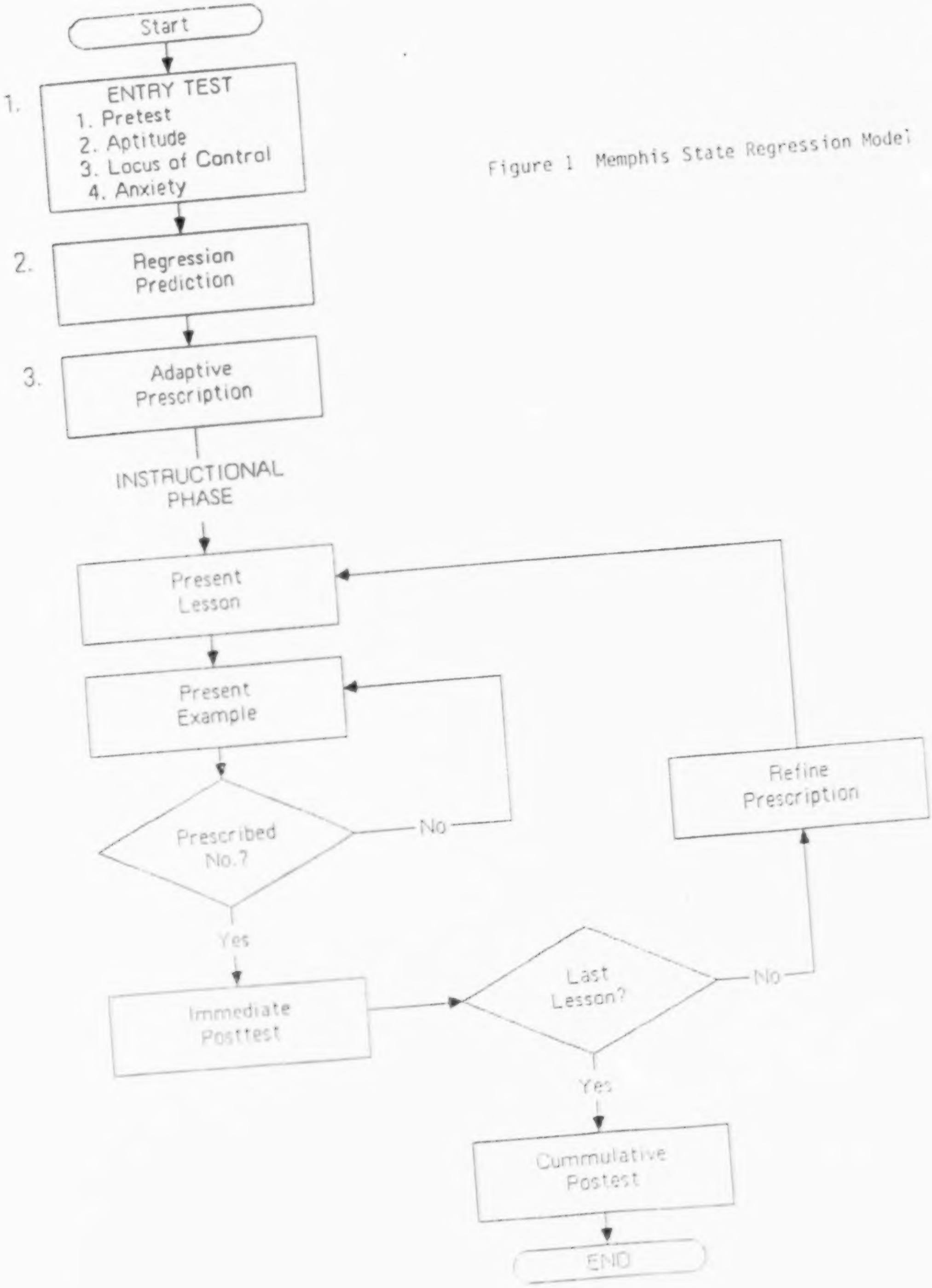
Start
1.
ENTRY TEST
1. Pretest
2. Aptitude
3. Locus of Control
4. Anxiety
2.
Regression Prediction
3.
Adaptive Prescription
INSTRUCTIONAL PHASE
Present Lesson
Present Example
Prescribed No.?
No
Yes
Immediate Posttest
Last Lesson?
No
Refine Prescription
Yes
Cummulative Postest
END

Figure 1 Memphis State Regression Model

Instructional Strategies in CAI:
Instructional Design Theory Needs

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Introduction

There should be no doubt in any of our minds that the computer is a useful medium of instruction and that it is potentially an unusually powerful medium. We would also all agree, I think, that our knowledge of what to do with the computer in instruction is less than perfect. I do not believe that there exists a body of prescriptive knowledge which tells us how to make best use of the computer's unique instructional medium characteristics when designing instruction which will be delivered by a computer. I will go further and assert that we don't even know much at all about instructional design that takes advantage of what a computer can do best. This paper will explore one avenue for new research and development in instruction: use of insights from the study of teaching for development of intelligent instructional software.

Computers, Teachers, and Other Media

I believe that a computer is more like a person than it is like other machines with regard to its instructional medium attributes. "With the exception of the teacher, no other delivery system equals the computer in its potential to accommodate the needs of the individual learner." (Carrier, 1985, p. 155) Although it is unusual to perform an instructional medium attributes analysis of human beings, it is possible to do so, as I did in 1982, albeit somewhat tongue in cheek. (Ragan, 1982) When a human is used in the role of an instructional instrument, we call that instrument a "teacher." This use of humans is so time-honored and commonplace that we do not even consider these units called "teachers" as instructional instruments at all, rather thinking of these "teachers" as one major means of delivery of instruction and everything else being either "instructional instruments" or "aids" to a teacher.

There are many attributes of a human which may help make him or her be a good instructional device, and there are also many attributes which make a teacher less than ideal. For example, humans are notoriously poor at being able to do something on one day in exactly the same way they were able to do it a year or even a day previously. This lack of repeatability makes teacher delivery so unreliable that it is at times difficult to understand how the use of "teachers" could possibly be as popular as they are in schools, disregarding their expense and other drawbacks.

The reason why the use of "teachers" is mandatory in not only schools but also training settings can be boiled down, I believe, to their enormously powerful information processing abilities. Although not perfect by any means (humans, for example, have a severely limited capacity for temporary information storage), humans have an incredible capability in their ability to do what they call "interact" based on information processing. Consider this: a human can receive what a student says or writes in natural language (this is called "listening" and "reading"), process that information (with humans, they call that "thinking"), and can ask a question or provide some other stimulus which is based upon what the student said or wrote.

Like the human, a computer's primary enviable attribute in instruction is information processing ability. Were it not for that, a computer would be a poor alternative for a text book with regard to legibility, a poor alternative to 35mm slides or an overhead projector with regard to graphic display, and a poor alternative to film and video with regard to providing animation. Although there are ways to improve a computer's performance in all of these areas, we don't use computers due to their fabulous display capabilities. We use computers because of their information processing capabilities.

When we try to use a computer in a manner like that which older media such as text, video, or programmed instruction could deliver--the automatic-page-turner sort of CAI--our efforts may be met with success in terms of student learning but we find we are open to scathing criticism for not making use of the computer's capabilities. And, regardless of whether other people criticize us or not, we know that all we have accomplished is to provide effective instruction in an area which can be provided with equal effectiveness through other means while, at the same time, topics abound within our curriculum which are veritable killers--learning tasks which only the most advantaged students fully master, leaving the remainder of the class--which in many cases is the majority--with limited success or complete confusion. It is these topics, the killers, that remind us that computers are supposed to be wonderful instructional instruments. But as we conceive of computer-delivery of instruction which is further and further from that which may be delivered by text, video, or programmed instruction, we find ourselves as instructional designers conceptually further and further away from anything we know much about.

If it is true, as I am saying, that we get further and further from the center of our base of knowledge and tools in instructional design when we attempt to design instructional software which makes effective use of the computer's unique attributes, what field of knowledge, if anything, might we find ourselves getting closer and closer to? Recall that earlier we noted an instructional medium which resembled computers in that its strength lay in ability to process information--the use of humans or "teachers." There is a field of study related to that one approach to the delivery of instruction and that field is called "the study of teaching."

The Study of Teaching and the Study of Instruction

The study of teaching is considerably separate from the study of instruction. A good general term for what most of our research in instructional technology relates to is "the study of instruction." But the research and theory interests of a teacher-educator or a professor of Elementary Education or of Teaching Methods in a subject area such as mathematics, language arts, reading, or social studies, will most likely be in the area and traditions of the study of teaching (not the study of instruction). Your colleague whose primary umbrella professional organization is not AECT but is ASCD (Association for Supervision an Curriculum Development) and who always has a difficult time understanding what it is that you actually do will probably have a primary background and interest in teaching research. By the same token, it is fair to say, I believe, that you have an equally difficult time understanding what that colleague does.

My conclusion from the above this: if the ways in which teachers effectively conduct instruction are different and in certain ways better than other media, and if teachers and computers share the critical capabilities of intelligent information processing, then two things may be predicted:

1. that the study of instruction, being devoted in the main to instruction delivered by non-intelligent instruments, would not include research and theory regarding what to do with an intelligent instructional instrument, and

2. that the study of teaching, being devoted in the main to instruction delivered by intelligent entities (humans), should include research and theory regarding what to do with an intelligent instructional instrument, the computer.

Artificial Intelligence and Instructional Design

My interest in the current topic did not begin with artificial intelligence (AI), but I have realized over the past year that a concern with teaching research in the context of instructional design for CAI, would lead quite naturally into contributions toward design of **intelligent instructional software.** Although I see little recognition of it in our literature as of yet, AI methods and techniques have already been developed which have enormous potential in instruction, (Schank, 1984) and there is good reason to believe that education, specifically the delivery of instruction, will be one of the most important uses of AI in the near future. "Automated, intelligent, individual instructors are one of the most interesting and socially significant possible applications of AI." (Schank, 1984, p. 205) Although the potentials appear to be enormous, and a number of people have noted to me their interest in the area, it does not appear that anyone knows much about design of what I will call "intelligent instructional software" or "IIS." Not only do we instructional technologists know little about IIS design, our counterparts in computer science appear equally unready. For example, Roger Schank, whose work in artificial intelligence at Yale University is discussed in The Cognitive Computer (Schank, 1984), appears as naive about instruction as anyone could possibly be in his discussions of uses of artificial intelligence in instruction. For example,

> If today's teachers were watching each child carefully, they could vary the complexity and amount of the examples in the books so that each child could maintain interest according to his progress. If workbooks were smart enough they could do this by themselves. But workbooks don't know whether or not a child is doing the exercises correctly, or how far he has gone. A workbook isn't able to stop him in the middle of page 54, exercise D, problem 13, and say, No, you've missed something, let's go back to that tricky problem on page 50. Nor can it say Great! You've got the hang of it. Let's go on to something else. Think of how alienating and dehumanizing the grade-school textbooks and the instruction that is coordinated with them really are. (Schank, 1984, p. 207)

One gets the impression that if left to their own devices, the computer science/AI community will do little more than re-discover programmed instruction, not going quite as far as re-discovery of instructional design.

In studying instructional strategies in CAI and in thinking about questions of the design of IIS, I became convinced that research findings from the study of teaching could be of enormous utility in enhancing our knowledge and tools for design of instructional software, both conventional and intelligent. Based upon this conviction I therefore set out to survey the research and theory in the area of the study of teaching. (Footnote: in this effort I am indebted to Prof. John F. Wedman, University of Northern Iowa, and to Jo Lynn Digranes, doctoral student in educational technology at the University of Oklahoma for their suggestions and ideas.) Rather than attempt a full summary of the literature in the study of teaching--an impossible task in this setting in any event--I would like to present to you the highlights of what I found, recalling if you will that I was looking for help in the design of instructional software.

The Study of Teaching in a Nutshell

The people's names I found most cited and recommended, and therefore whose writing I concentrated on in my survey were: David Berliner, Philip Hosford, Christopher Clark, Robert Yinger, Barak Rosenshine, N.L. Gage, and Madeline Hunter. Topics and key ideas within the study of teaching which I found most repeated and emphasized as major areas of interest were: teacher effectiveness, teacher thinking, and models of teaching. Of all the material which I read, I would recommend as a single most helpful source, Using What We Know About Teaching, Edited by Philip Hosford and published by the ASCD. (Hosford, 1984)

The following areas were used as primary organizing topics by Berliner in his discussion of the status of teaching research (Berliner, 1984):

A. Pre-instructional factors
    1. Content decisions
    2. Time allocation decisions
    3. Policy decisions
    4. Grouping decisions
    5. Decisions about activity structures

B. During-instruction factors
    1. Engaged time
    2. Time management
    3. Monitoring success rate
    4. Academic learning time
    5. Monitoring
    6. Structuring
    7. Questioning

C. Climate factors
    1. Communicating academic expectations for achievement
    2. Developing a safe, orderly and academically-focused environment for work
    3. Sensible management of deviancy
    4. Developing cooperative learning environments

D. Post-instructional factors
    1. Tests
    2. Grades
    3. Feedback

The content of most of the topics is descriptive in nature. For example, with regard to content decisions, the research indicates that the factor exists; in other words, that teachers do in fact make content decisions from time to time. The research does not speak to how teachers make content decisions or how best content decisions should be made.

Berliner's summary emphasized for many topics that there is a great amount of variability among teachers. This was the primary finding summarized for time allocation decisions, for policy decisions, and for activity structures.

For the remainder of the topics, the primary findings noted can be characterized by "performance of this function is correlated with student learning" or by "teachers who do this more than most teachers have students who achieve more than average." For example, studies are cited which indicate that there is a strong relationship between success rate (how often the learner is successful on things like exercises, problems, and so forth) and achievement. Rather than note the utility of instructional instruments such as programmed instruction in this regard, the a typical conclusion for teaching research is drawn: "It appears that the classroom in which the teacher moves rapidly about, monitoring students and raising the number of substantive interactions with students, is the class where students do well." (Berliner, 1984, p. 62) "A substantive interaction between a teacher and student takes place when the teacher checks to see if the student is doing things correctly, asks questions, gives the student academic feedback, and so on." (p. 62-63) Both tutorial CAI and programmed instruction do this sort of thing routinely. In one sense, we can turn this area into a design recommendation, albeit not too innovative one: "CAI software should be designed so that it checks student work for accuracy, that it asks questions, and that it provide feedback." On the other hand, a question presents itself for which we do not have a ready answer: what difference does it make to have a **human** do these things? If it is the case that a human is needed, what are the critical variables? Are there particular behaviors that only humans can produce (at present)? If so, an expert system protocol analysis of teacher monitoring behaviors would appear needed if we are going to get into AI in instruction. Or is the critical factor not what the teacher does but what the teacher is: a person. If that is the case, in what regard does the student's knowledge that the teacher is a person make a difference?

In another review, Hosford (1984) summarizes the "science" of teaching to be found in five factors:

T - time on task (sufficient amount)
E - expectations (projection of high expectations for learning)
M - monitoring student progress
P - problems assigned (individual work which can be done individually)
O - organization (manage class so well that discipline is not a problem)

The "art of education" is seen in teacher's fostering and characterization of what Hosford calls the "silent curriculum"--four broad areas, three of which are ignored by a school's manifest curriculum, but associated with greatness in teaching:

1. desire for learning
2. improved self-concept
3. respect for others
4. skill in the use of the 3 R's

Teachers who can impart in students a desire for learning, who contribute to improvements in their students' self-concepts, who show a respect for others and teach their students to do so, and who are themselves highly skilled in the basics and improve their students' achievement in the basics are what Hosford would characterize as being "high art" teachers. Teachers who are good with regard to behaviors within the "science" domain he would characterize as "high science." The best teaching would be both high art and high science.

Are Hosford's factors the sorts of things we can employ in design of intelligent instructional software? Although Hosford's factors are quite broad, perhaps they--even the "art of education" factors--are areas in which we can begin some productive work. If, for example, one were to perform a protocol analysis of teaching, where would one start? It seems only reasonable that if we want to develop principles for intelligent instructional software, that we should begin by focusing investigations on the areas within which the most is known and which are considered most important by the people whose field is research into the phenomena which we wish to model.

In another review, Bauman (1984) cites nine factors of teacher effectiveness, reminiscent of those we have already seen:

1. clear goals and objectives
2. allocated time
3. academic engaged time
4. success rates
5. management
6. monitoring
7. direct instruction (the provision of)
8. instructional organization
9. classroom atmosphere

Similarly, Rosenshine (1983) provides six functions, from six studies of teacher effectiveness, which describe what effective teachers do:

1. review and checking previous day's work
2. presenting new content/skills
3. initial student practice (and checking for understanding)
4. feedback and correctives (and re-teaching if necessary)
5. student independent practice
6. weekly and monthly reviews

Clark and Yinger (1977) reviewed research on teacher thinking. This work, quite different from the work on teacher effectiveness, may be relevant to requirements and specifications for intelligent instructional software. One major question addressed by the research on teacher thinking is that of interactive decision-making. It had been assumed that teachers do a great deal of decision-making on their feet, as it were, in the classroom. The research indicates that they do, but not much. Teachers consider alternative strategies only when things are going poorly. In other words, teachers apparently do not make efforts to optimize learning. Student participation and involvement are the primary cues used by the teacher, and, in fact, teachers rarely change their strategy.

Another facet of the teacher thinking research reviewed by Clark and Yinger is the content of teachers' "interactive thoughts." (p. 294) Teachers apparently think about present, past, and future issues while interacting with students. Teacher thoughts about the present are primarily about student behavior and their own affective state. Teacher thoughts about the past are concentrate on reflection on past events within the present lesson, retrieval of factual information such as personal information about particular students, curriculum content, principles of teaching, and beliefs about children (learner characteristics). Finally, teacher thoughts about the future are primarily on tactics to be used next in the current lesson, predictions or visualizations of directions the lesson might take, and expectations for student behavior and student learning of objectives.

The research on teacher thinking may be a good place to begin when determining information processing requirements and structures for AI-based intelligent instructional software.

Finally, I would like to present a key point or two from an individual study rather than a review. The study, Yinger (1980), was a single-subject study of teacher planning. The aspect of the study which I found of most interest was the investigator's report of the teacher's use of "routines." These "teaching routines" were mechanisms used to establish and regulate activities and to simplify planning. Four types of routines emerged: 1. activity routines, 2. instructional routines, 3. management routines, and 4. executive planning routines. These teacher routines appear to have, at a superficial level at least, a close correspondence to general-level computer system activity descriptions.

Conclusions from Teaching Research

When I began my survey of teaching research, I had hoped that I would find prescriptively oriented theories and models of what effective teachers do and how they do it, similar to instructional design theories and models but with reference to teachers rather than materials or systems. I hoped, particularly, to find analyses of the nature of interaction, questioning, and feedback. I did not find what I hoped for. Although I do not claim my survey of teaching research reviews to be an in-depth review itself, I think this survey fairly grasps the nature and quality of the mainstream of recent research on teaching. Perhaps another survey of the research on teaching should be performed, this one not focusing on the recent research but on finding useful information in what appear to be areas of most potential: interaction, questioning, and feedback.

I have noted earlier, while discussing various reviews, that the possibility exists of using some of the work reviewed as a beginning point for protocol analysis for development of expert systems. I would like to expand that idea and suggest that instructional researchers may wish to begin to study teaching themselves. This new study of teaching would build upon the existing literature but would proceed along new directions. In other words, if what we need isn't there, we may have to do it ourselves. We will have to study teachers and teaching to establish protocols for our "automated teachers." In so doing, we will not only need to begin where the current work leaves off (rather than painfully rediscover the wheels of teaching research) but also we may find the skills and perspective of seasoned teaching researchers to be invaluable.

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EVALUATING MEDIA SUPPORT SERVICES:

AN ETHNOGRAPHIC APPROACH

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ABSTRACT

An examination of the evaluation of media services in a school of nursing utilizing qualitative research methodology is presented. Since ethnographic methodology differes significantly from research approaches more commonly used in education, it is important to identify and understand the differences in this alternative approach. This study considers these differences and provides an application of this methodology in the evaluation of media support services within a school of nursing. Pertinent evaluation and ethnographic literature are reviewed to provide a theoretical basis for this discussion.

A one year prototypical study employing ethnographic methodology was undertaken to evaluate media services within a school of nursing. Objectives were established in the areas of needs assessment and evaluation of the condition and context of media services. Data was collected through interviews with and attendance at faculty committee meetings, informal observation and interaction with nursing faculty, students and administrators, observation of the process of media support services, collection of media utilization data and the establishment and maintenance of contact with university level media personnel, both formal and informal.

Media and instructional support needs were identified and classified in four areas. These categories were: (1) Organization, (2) Administration, (3) Service, and (4) Production.

Recommendations are specified on the basis of examined conditions relative to the four categories of need. Plans for action and future development direction emerged from the analysis of qualitative data.

INTRODUCTION

Evaluation of media support services is both assumed and systematically planned for in the on going process of media services management (Erickson, 1968). Moreover, A.E.C.T. (1982) suggests that in addition to quantitative factors, qualitative considerations may be necessary to effectively evaluate specific programs of media support. Therefore, the purpose of this study is to identify qualitative research methodologies which are suitable for evaluation of media support services. Furthermore, an ethnographic approach is then applied to the evaluation process of media services in a school of nursing.

REVIEW OF THE LITERATURE

Three areas of consideration emerge from a review of the evaluation and media support/educational technology literature. The three areas are: (1) Issues of research, (2) Considerations related to the naturalistic paradigm, and (3) Ethnographic methodologies. Issues of research include considerations of paradigmatic differences, questions of methodology and the resolution of apparent differences.

Paradigmatic differences have been addressed by Guba (1981), Guba and lincoln (1981) and Guba and Lincoln (1982), relative to defining naturalistic inquiry. Essentially for research purposes, paradigms may be viewed as patterns for discovering knowledge. Therefore, different paradigms rest on different philosophical foundations with varying sets of assumptions relative to the research phenomena in question (Donmoyer, 1985;Guba and Lincoln, 1982). Hence, due to differences in world view, varying paradigmatic approaches have in fact, produced a heated debate both philosophically and operationally. Most notably has been the discourse between "rationalistic" and "naturalistic" means of inquiry (Howe, 1985).

Philosophical stances have lead to perceived differences in methodology. Methodological differences, according to Guba (1981) have been viewed in terms of quantitative versus qualitative preferences. However, Guba (1981) further suggests that methodology concerns are better analyzed when viewed in relation to the trustworthiness of the results which those methods yield. Hence, when viewed in relation to aspects of trustworthiness (ie.: truth value, applicability, consistency and neutrality), questions of validity, reliability and objectivity from a "rationalistic" perspective, may in fact find a commonality of agreement when defined in terms of credibility, dependability and confirmability, from the "naturalistic" perspective.

Moreover, Cook and Reichardt (1979) suggest that a resolution to the "rationalistic"/"naturalistic" debate, on at least the methodological level, is the use of both qualitative and quantitative methods where appropriate. Hence, Guba (1981) and Guba and Lincoln (1982) propose the triangulation of methodology through the collection of data from both perspectives.

The second major area of consideration relative to the literature review, is that of analyzing aspects of the naturalistic paradigm. This analysis may be viewed in terms of the two areas of philosophical assumptions and methodology considerations. There are five areas of philosophical assumption relative to the naturalistic paradigm (Guba, 1981; Guba and Lincoln, 1982). First, Guba (1981) suggests that there are multiple realities which may in fact, be studied holistically. Second, the researcher and object or "respondant" have an interactive relationship, with each influencing the other. Third, generalizations are not possible due to the fact that knowledge is bound both by time and context. Forth, since actions are best explained in terms of the interaction of multiple factors, methods of assessing phenomena are most appropriately determined by the notion of "best fit," relative to a contextual/holistic approach. Fifth, the research endeavor (inquiry) is value bound. These five areas of philosophic assumption impact methodological applications for the practicing evaluation researcher.

Methodological considerations would include a wide variety of data gathering techniques. Guba and Lincoln (1982) suggest a number of techniques, such as interviewing, observation, record analysis and non-verbal cueing behaviors. Moreover, Patton (1980) and Van Maanen (1983) both address a number of related issues dealing with the application of and collection of data by qualitative methodologies. While quantitative methods as identified by Campbell and Stanley (1963) may also be included in the research design in order to triangulate findings (Cook and Reichardt, 1979). Finally, methods may in fact be determined by the unfolding of the study according to Guba and Lincoln (1982).

Based on the fore going considerations, the utilization of ethnographic methodological approaches appear to be not only useful, but also highly appropriate to the evaluation of media support services, from a qualitative perspective. Wilson (1977) and Fetterman (1984) suggest specific considerations for the use of ethnographic techniques in evaluation research. Accordingly, Shrock (1985) notes that the results of naturalistic studies tend to be process oriented, holistic and personally/politically sensitive.

Therefore, the study reported herein, is that of a one year prototypical study employing ethnographic research methodology from a naturalistic perspective, in order to evaluate media services and to determine areas of need for further development in support for a school of nursing.

METHOD - THE ETHNOGRAPHIC APPROACH

The methodology section of the study includes delineation of the context/institutional setting, as well as data collection activities and data analysis. The delineation of the institutional setting and contextual considerations provide for a higher degree of transferability of results by providing descriptive data which may be compared with other settings and contexts (Guba, 1981). Therefore, this study took place at a four year private university, within its school of nursing. The school of nursing offers a four year baccalaureate program in nursing accredited by the National League for Nursing. Nursing students receive instruction on campus, while gaining related clinical experience at various local health care facilities. An intensive program of individualized auto-tutorial instruction with clinical simulation laboratory experiences predominates the junior and senior levels. Several graduate programs leading to a Master of Science degree in Nursing (M.S.N.) are also offered, as is a course of studies leading to a Doctorate in Nursing Education. Undergraduate enrollment is approximately six hundred with graduate students numbering approximately two hundred and twenty. Combined undergraduate and graduate faculty total approximately fifty five (FTE).

Media support is provided through a specialized nursing media support group for students' individualized instruction, clinical simulation laboratory experiences and several small classrooms within the school of nursing's building space. Classroom support outside of the nursing building is provided through a campus wide centralized media center. The nursing media support area maintains a collection of nursing related software materials, instructional kits and AV hardware. These materials are housed in a small closet area and are checked out by students and faculty for use in smallgroup viewing rooms located throughout the nursing building space. Instructional kits for clinical simulation laboratory use are checked out and used in the laboratories, located in another part of the nursing building. Staffing consists of one full time supervisor (R.N. with no formal media training), two part time work-study students and a laboratory assistant (part time). Faculty are primarily responsible for instructional activities utilizing this service.

Guba (1981) suggests that by collecting "thick" descriptive data, a higher probability for transfering results to other contexts may be achieved due to the comparison "fit" of contextual description. Therefore, issues of external validity and generalizability are addressed from a naturalistic perspective through the utilization of methods which are appropriate for determining a high degree of transferability.

Data collection activities included a wide variety of ethnographic and naturalistic methods, as well as, quantitative measures. Specific activities included: observation of faculty meetings and committee meetings; structured interviews with faculty, students and administrators; informal observation of instructional activities, both in terms of faculty and student involvement and interaction; examination of faculty/administration generated documents; informal conversations with faculty, students and administrators; observation of the process of media support services; collection of media utilization and evaluation data; and formal interviews and informal conversations with university level media support staff and administrators.

Observation of faculty meetings and committee meetings provided data for log entries. Log entries included any activities, discussion or disclosure relative to media support, as well as, reactions, questions and other social interaction. These data were cross checked with documents generated by the various committees and respective administrators. This activity provided a level of credibility relative to findings (Guba, 1981).

Structured interviews with faculty, students and administrators were conducted. The use of standardized open-ended interviewing techniques (Patton, 1980, p. 202) provided a reduction in bias due to the standardization of questioning for each of the different groups interviewed.

Informal observation of instructional activities yielded interesting responses from both faculty and students in natural contexts and settings.

Examination of faculty and administration generated documents served as references for cross checking observationaldata (Guba, 1981). Primarily, these documents consisted of committee minutes, memo's, annual reports and task force reports to accreditting agencies.

Informal conversations with faculty, students and administrators provided additional data which reinforced observational and interview data (Patton, 1980, p.198).

Observation of the media support process provided log entries which lead to an understanding of logistical problems and processes.

Collection of utilization and evaluation data provided for the triangulation of data from a quantitative perspective (Guba, 1981). This process assisted in the cross checking of data and interpretations established by the qualitative methodologies.

Formal interviews and informal conversations with university level media personnel tended to clarify need areas identified by faculty, students and administrators in the school of nursing. Moreover, this activity provided for peer debriefing experiences for the researcher.

Member checks were provided through the process of combined observation and interviewing of the various population groups involved in the study. This member feedback provided for the possibility of higher levels of credibility (Guba, 1981).

Data analysis emerged from and in conjunction with the data collection. Specific themes relative to needs and development direction for media support services were identified. As related themes emerged, they were checked in terms of source origination and multiple response. As various population group and techniques identified related themes, the themes were then defined in terms of media support need and related direction development. For example, when organizational concerns were expressed by the three groups of faculty, students and administration, the cross checking of these references lead to the emergence of organizational need areas.

RESULTS

Based on the data gained from the variety of methods utilized, a conceptual structure of media support service need categories emerged. Moreover, recommendations specified on the basis of the examined conditions provided a structure for strategy development relative to the need categories.

The conceptual structure of identified needs consisted of four areas. The four categories relative to media support are: (1) Organization, (2) Administration, (3) Service, and (4) Production. Organizational considerations included better organization of distribution of hardware/software materials to faculty and students; structured individualized learning areas; identification of lab practice areas; and establishment of comprehensive indices and inventories for collection holdings.

Administration concerns included staffing, funding and supervisory considerations. Specifically, questions of necessary staffing levels for media/lab support, budgeting process development, oversight of student simulation experience, responsibility for lab supplies and collection maintenance were identified.

Service needs included areas in which media support service would be able to support faculty in the instructional process through the utilization of instructional design, development and evaluation principles and practices. Specific service needs included the following: faculty orientation to the possibilities for media utilization within the instructional process; identification of media users and opinion leaders; continued development of the hardware/ software collections; and faculty consultation for instructional design, development and evaluation.

Production needs included specific applications of technology to the instructional process in order to further achieve a broad-based learning environment through the production of materials designed to meet specific learner needs. Specific production needs included: utilization of basic graphics production for media design; video programming applications to instructional tasks, delivery systems and testing strategies; application of computer technology to competency based instructional strategies; and development of graduate level instructional materials.

Recommendations were then developed on the basis of the present contextual condition of media support service need categories. Organizational procedures for the effecient and effective function of media distribution were developed. Administrative recommendations were specified in terms of staffing, budget, supervision, procedural specification and collection maintenance. Role function of media service staff was identified. Service recommendations were developed in terms of instructional support perspective including areas of inservice training, identification of media users/opinion leaders, and consultation for future development endeavors. Production recommendations emerged directly from data yielded from the qualitative methodology.

Staffing considerations evolved from the specification of support recommendations. Moreover, cooperative ventures were identified relative to university level library and media support departments. Channels of communication were identified and formalized.

DISCUSSION

The present one year study sought to identify qualitative methods which would be suitable for the evaluation of media services within specific contexts. Moreover, an ethnographic approach was then applied to the evaluation process of media services in a school of nursing. Categories of media support need then emerged from the activities of data collection and analysis. These need categories provided a basis for developing a structure of recommended development.

The process of evaluation is on going, due to the evolutionary nature of media support bound in space/time contexts. Therefore, this study merely serves as a prototype for an on going evaluation methodology process within the school of nursing. Needs must continue to be identified, strategies implemented and evaluation undertaken.

One must not, in this process lose sight of the central goal of instruction. Therefore, future directions will be shaped by emerging needs and the strategies implemented to meet those needs provided by the continual process of evaluation.

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THE EFFECT OF LOGO ON YOUNG CHILDREN

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Abstract

In the Spring of 1983, twenty-five second grade students from a public elementary school in New Mexico had their regular curriculum supplemented with the experience of LOGO computer programming. This experiment studied the effectiveness of LOGO's turtle graphics in providing the subjects with a model of systematic thought which could be applied and measured in an adapted Piagetian problem solving activity. The study also investigated LOGO's effectiveness in teaching certain fundamental geometric concepts to children who were supposedly not developmentally ready for such material. The treatment consisted of each child receiving approximately one hour of Terrapin LOGO programming on the Apple microcomputer each week for three months. The structure of the programming experience was based on a guided discovery approach. The children were allowed much freedom in their programming choices, yet they were motivated to pursue formal stage thought patterns using a carefully planned positive reinforcement technique. Data from the experimental group were compared to another second grade classroom in the same district which did not receive any LOGO experiences. The experimental group showed statistically significant results in both the problem solving measure and geometric pencil and paper test. The control group showed no significant change in either case.

The Effects of LOGO on Young Children

Introduction

The introduction of the LOGO programming language to mainstream education in the late 1970's and early 1980's received much attention and initial praise. Even though not much was known empirically about the use of LOGO with children (Watt, 1982), it was nonetheless brought into many classrooms across the country with rushed excitement. Many educators facing the responsibility of utilizing the growing microcomputer medium turned to this innovative concept with the hope of providing children with a suitable and profitable educational experience. In lieu of the research and field-test data, many educators took the word of a small group of scientists and theorists at the Massachusetts Institute of Technology (MIT) that children's exposure to LOGO could possibly yield favorable results in thinking and mathematical ability. Furthermore, it was contended that these results would be best achieved given a revolutionary break from the traditional, and often admonished, teacher dominated classroom and proceed to a highly child centered environment (Papert, 1980). This educational bandwagon was further encouraged by the public's insistence that education begin to prepare its youth for the already present computer age. These factors, among others, have contributed to LOGO's somewhat ubiquitous reputation as being possibly the most significant educational software of the decade (Lough, 1983).

Confirming evidence of LOGO's ultimate educational value was expected from some of the early LOGO projects such as the Brookline, Massachusetts project and the Lamplighter project in Dallas. Unfortunately, these projects did not provide educators with convincing evidence of LOGO's potential and the argument for and against LOGO continued. Recently, however, the findings from several large LOGO projects, such as the Bank Street College Project in New York and the University of Israel Project, have cast rather dark clouds over the LOGO landscape. These studies attempted to present LOGO to children in the context of free or open discovery learning as advocated by Seymour Papert, LOGO's principal developer. In these studies, LOGO failed to show any significant contribution to the children's problem solving or mathematical skills (Pea, undated; Leron, 1985). In another study completed at the University of Edinburgh, Scotland, LOGO was presented in a more traditional and structured way. LOGO was substituted for the regular mathematics curriculum and was taught in a structured, teacher directed way. Here again, LOGO did not provide a superior learning environment over non-LOGO instructional methods: students in the LOGO group did not perform significantly better on math achievement tests than non-LOGO math students (Howe, O'Shea & Plane, 1979). These results, and in particular, the results from the Bank Street College of Education "raise serious doubts about the claims made for the cognitive benefits of learning to program, particularly in LOGO" (Pea, undated, p. 30-31). These results have prompted many educators to call for a halt in the use of LOGO and LOGO-like experiences in the classroom (Tetenbaum & Mulkeen, 1984). These studies support a contention that LOGO has failed to deliver what it had promised.

In response to these criticisms, Papert has emphasized that LOGO never promised anything. Instead, he supports the view that LOGO is part of a cultural influence. Considering LOGO by itself, without associated cultural factors, is devoid of meaning (Papert, 1985). This is why, according to Papert, it is fruitless to try to control for the "LOGO variable" in experimental type research.

Papert's criticism, although perhaps valid to a certain extent, leaves the concerned educator in a type of "damned if you do and damned if you don't" situation. Educators who try to understand Papert's perspective and attempt to aspire to the potential of LOGO find themselves confronted with unimpressed curriculum supervisers demanding supportive data whereas researchers are accused of contaminating a good idea with their experimentation techniques. Ultimately, educators will need to have an objective measure of the possible influences of LOGO and LOGO-like experiences on their students in order to justify continuing or abandoning the cause. These decisions will need to be based, at least in part, on information gathered through experimental research.

Purpose

The purpose of this paper is to present and discuss a relatively recent study involving the experiences of young children who used LOGO over a three month period. The purposes of the study were two-fold. First, it has been claimed that people who engage in LOGO programming, or other similar languages for that matter, are apt to better develop problem solving abilities (Papert, 1980) due to the nature of the programming tasks. Programming with LOGO, it is contended, supports a systematic structure of procedural problem solving where large problems are broken down into smaller, more manageable "chunks". This study sought to investigate whether or not young children, given the experience of LOGO programming, would acquire more problem solving skills and be able to demonstrate those skills in other problem solving contexts.

The second problem investigated and discussed here concerns the potential of learners to gain incidental mathematical insight and ability through their LOGO programming experiences. These skills are termed incidental because they are not taught directly by the teacher, but are acquired as a by-product of the total programming experience. The rationale behind this is based upon the structure of LOGO itself. The language of LOGO is a language where mathematics is communicated between the learner and a small cybernetic animal called the "turtle". The learner, in his/her physical world, and the turtle in its, share many important traits. The two most important traits that they share are position and heading making the turtle body syntonic with the child (Papert, 1980). In addition, since the child is able to identify with the turtle through these physical associations, Papert contends that the child and the turtle begin to share a type of cognitive bond. This bond, or ego syntonic relationship, allows the child to project his/herself according to the perspective of the turtle. It is through these means that the child is believed to be able to gain mathematic insight not readily attainable through traditional means. This belief becomes even more interesting when the learners are especially young, as in the second grade. According to the child development theories of Piaget, the preoperational or concrete operational child does not view the world as being filled with rigid and fixed shapes. Rather, the child views the world with a more topological perspective where lines and angles are permitted to bend and flex (Copeland, 1979). Therefore, the second problem to be discussed here is whether or not young children are able to assimilate some basic geometric concepts and the notion of perspective and rigidity even though their cognitive development dictates a more topological viewpoint.

Methods

Subjects

Subjects in the experimental group consisted of 25 second grade children from a regular, public school classroom. The experimental group consisted of 15 boys and 10 girls with ages ranging from seven to nine years with a mean age of 8.08 years. The control group also consisted of an intact, second grade classroom. This group was from a different school in the same school district. The control group consisted of 22 children: 11 boys and 11 girls whose ages also ranged from seven to nine years with a mean age of 7.82 years. The rationale for using a control group was based upon the need to control for maturation effects of the experimental group (Campbell & Stanley, 1963). The experimental and control groups were selected based in part upon the willingness of their teachers to participate and other more restraining factors typically found in field-based research which prevented random assignment of subjects to the treatment groups.

Materials

The treatment given to the experimental group was the experience of programming a microcomputer in the computer language of LOGO. Each subject received approximately one hour of LOGO programming each week using the Terrapin version of LOGO on the four available Apple II+ microcomputers. These four microcomputers were also used by the rest of the school's population. Since this study was conducted within the confines of a public elementary school it was therefore subject to all of the limitations inherent in this type of setting. Although this quasi-experimental design makes proper control of experimental variables more difficult, there are some merits to be considered. For example, the LOGO learning environment created here is probably not much different from those to be found in schools all across the country and thus the results can probably be more easily generalized to current classrooms.

The LOGO Learning Environment

Initially, the LOGO experience presented to the experimental group was planned to conform to Papert's "free discovery" or humanistic style philosophy where the teacher acts as a facilitator rather than a fact giver. In this type of setting, a teacher who is well acquainted with the programming or "nuts and bolts" aspects of LOGO acts as a facilitator giving the child advice, informative feedback, technical assistance and other "on-task" information whereas the child's role is to take an individual learning path with the responsibility of generating ideas as well as the bulk of the creativity. Shortly after the treatment began, however, it became very obvious that the subjects would require much more time than the three months allotted to even begin to attain the programming level thought necessary for any significant differences to be detected. For this reason, it was necessary to develop a way to motivate the subjects to progress in a quickened, yet consistent, way. So instead of allowing the children to explore with the turtle with total freedom, as Papert advocates, a different approach was used which still provided the children with much freedom.

A series of activity cards was prepared. On each card was a simple shape, such as a square. If the child successfully recreated the shape on the computer's monitor, then a "chance slip" was rewarded. This chance slip was put into a jar which was later used to draw for prizes. The more chance slips in the jar at the time of the drawing, the better the chance to win a prize. The shapes on the cards were then made increasingly more complex. The skills learned on one card might be prerequisite on another. (Copies of selected activity cards can be found in Appendix I.) This building block method of skill development along with the reward system proved to be extremely successful. The children were not forced to complete the activity cards, just merely coaxed. Many times a chance slip was awarded if the child would try to alter something in their design according to the instructor's directions. This was done to help the child achieve a concept which otherwise would have been missed. This "guided discovery" technique has worked well in this and in other LOGO environments occurring in typical school situations.

After the child successfully completed several activity cards with little difficulty, the child would be encouraged to combine these shapes to make a larger figure. Any figure created by the child which was composed of activity card shapes was also awarded a chance slip. This encouraged the children to record successful programming code in a notebook. The code for several single shapes was often used with little modification when joined together to create the macro design.

The control group received no such LOGO exposure or any microcomputer experience for that matter during the time of the study. Although the two groups had different teachers, it must be restated that both were in the same school district and therefore both received similar instruction in terms of content since both classrooms had similar classroom materials apart from the computer experience, such as identical textbooks and district objectives.

Dependent Measures

Evaluation of LOGO in classroom or other settings has been controversial among LOGO's promoters and critics. Although LOGO enthusiasts tend to reject the notion of testing in any LOGO microworld, the problem of objective evaluation remains. Justifying the inclusion of any major curriculum component requires accounting for supposed educational gains in clear, objective terms. LOGO's effectiveness and potential learning and instructional benefits appear to be centered in two areas: problem solving and mathematics. These two areas closely resemble the distinction between crystallized and fluid intelligence as described by Catell (1971). An objective of this study was to examine a possible evaluation procedure of LOGO which considers these two facets of intelligence.

There were two dependent measures used in this study. The first was a measure of problem solving ability in two parts and the second was a paper and pencil geometry test. Both measures were administered by the researcher to the experimental and control groups in a pretest/posttest design.

The problem solving measure is a quantitatively derived form of two classical Piagetian activities used originally as examples of problem solving in individuals at the stage of formal operations. This measure was presented individually to each subject in each treatment group in two parts. One part involved a combinatorial task and the other a permutation task. These tasks were chosen as a possible solution to the conflict of evaluating problem solving due their historical use as relative indices of formal thought in Piaget's Theory of Intellectual Development (Copeland, 1979). These tasks were then supplied with a scoring technique which would allow them to be statistically analyzed.

In the combinatorial activity, the child was shown six piles of different colored markers. The task was to arrange the markers in as many combinations of pairs as possible. It was strongly emphasized by the researcher to the subjects that no repeated combinations could be permitted. All discovered combinations of the possible 15 were scored one point each. However, one point was subtracted for each combination repeated by the child. Fifteen points was the highest score possible with the lowest possible score being zero.

Each subject was instructed to complete the task involving permutations in a similar fashion. The child was shown four piles of different shapes: squares, triangles, stars, and circles. The task here was to remove one shape from each pile and then arrange the four shapes in a different way from all previous trials. Again, it was emphasized to the child that all of the arrangements must be found with no repeats permitted. The scoring technique here was identical to the combinatorial activity: repeated arrangements were subtracted from the total sum of identified permutations with 24 being the highest possible score and zero the lowest.

Each subject's raw score for this measure was the sum of the combinatorial and permutation tasks.

The measure of geometric concepts was administered in a group setting to each of the treatment groups with measurement tools such as rulers and protractors provided. The test consisted of four pages (see Appendix II). Page one consisted of an angle recognition activity where the child was instructed to select the proper angle from a group of four. Page two also dealt with the concept of the angle. The subjects were given an angle and one ray of another angle. The subjects were instructed to draw the second ray in such a way that the angle formed would match the given angle identically. Additionally, the given rays were offset somewhat from the given angles so that the child had to consider the task from a different perspective. Page three dealt with the measurement of line segments. One line segment was given with the child being told to draw another line of exactly equal length. The starting point for the child's line was given and offset in such a way as to require the child to demonstrate conservation of length. The fourth page also dealt with the concept of the angle. Here the child was instructed to imagine rotating a given figure a certain number of degrees left or right and then to point to the direction in which it would be facing. This task resembles more closely the activity actually involved in LOGO programming. Whereas the first three geometry test pages attempted to measure far transfer of LOGO's mathematical model, the fourth page was designed to measure one near transfer component.

Analysis of the Data

Problem Solving

An analysis of the experimental and control groups' pretest means, 11.52

and 11.27 respectively, on the problem solving measures using an independent t test show that the two groups means were statistically similar, t(45) = -.1588, $p<.01$ in problem solving ability at the onset of the study. (See table 1 for the groups' descriptive statistics.)

The experimental and control group's posttest means were 17.6 and 10.59, respectively. The analysis of these means using an independent t test showed a highly significant difference, t(45) = 4.87, $p<.01$. Therefore, the null hypothesis can be rejected and the conclusion drawn that these means are statistically different.

An additional analysis comparing the pretest and posttest means of each group using dependent t tests also support the above conclusion (although this is not the preferred statistical technique). An analysis of the experimental's pretest and posttest means show a highly significant difference, t(24) = 4.9, $p<.01$, whereas an analysis of the control group's pretest and posttest means show no significant difference, t(21) = -.5718, $p<.01$.

Insert Table 1 About Here

Geometric Mathematical Ability

As in problem solving measure, the experimental and control groups were determined to be at similar levels of geometric mathematical ability at the start of the study as determined by an analysis of their pretest means, 11.4 and 11.73 respectively. An analysis of these data using an independent t test show no significant difference, t(45) = .4024, $p<.01$.

The experimental and control group's posttest means were 14.8 and 12.5, respectively. A comparison of these means using an independent t test showed a moderately significant difference, t(45) = 1.78, p<.1.

The additional analysis of the experimental group's pretest and posttest means using the dependent t test show a significant difference, t(24) = 3.21, p<.01, whereas the control group showed no such difference, t(21) = .9287, p<.01.

General Discussion

The findings of this study tend to support the hypotheses and general educational philosophy of LOGO's developer, Seymour Papert, in two important ways. First, the group of children who used LOGO in this study performed better on the problem solving measures than the group of children who received no such LOGO programming exposure. This is consistent with Papert's conjecture that successful programming interactions encourage the development and exercise of problem solving strategies. These results give evidence that these strategies might be able to transfer beyond the context of computer experiences. These results in the area of problem solving are in stark contrast to many of the findings reported by the Bank Street College researchers and the University of Israel researchers. Second, the LOGO programming group appeared to gain mathematical insight to certain geometric tasks merely by their LOGO programming experience, whereas the non-LOGO group did not change significantly during the three months in which the study took place. These geometry aptitude findings presented here appear to contradict the findings from the University of Edinburgh work. Furthermore, these results were obtained in a very young group of children and were the result of direct computer programming interactions, i.e. no supportive non-computer instruction was provided.

One difference between previous studies and the one presented here which might help to explain the inconsistencies concerns the learning environment in which the LOGO programming took place. This study presented LOGO in a "guided discovery" environment where although the teacher played an important role in the learning paths taken by the students, there was still an enormous amount of freedom for the students to experiment with the LOGO microworlds. This possible explanation is supported by findings of another LOGO study in which a guided discovery environment was also encouraged. The experimental group in this study, conducted at the California Polytechnic Institute of California, also showed significant mathematical gains (Cron, 1983). Although it was not the intention of this research to examine the attributes of successful LOGO learning environments, this insight should be considered by current teachers in the planning of computer education experiences which will involve LOGO.

Although the experimental group showed a significant increase in their problem solving ability as measured by the combinatorial and permutation activities, one question which must be asked is whether or not this difference is important. It would be a naive conclusion to state that any single measure could evaluate something as complex as the construct of problem solving. Attempting to evalute problem solving or systematic thought using a single measure is analogous to holding a highly detailed object in front of a bright light and then studying its shadow on the wall; the shadow gives the observer only the faintest notion of the object's complexity. Therefore, since these results show much promise for LOGO's ability to present a problem solving model to learners, much more research is needed. These results show that learners who use LOGO appropriately and regularly appear to gain incidental problem solving aptitude, that is, the problem solving ability gained is the result of the programming experience, not as the result of direct teaching.

Other studies have shown that there are more efficient ways than LOGO to increase problem solving in children (Dalton, 1985). Yet, since this increase in problem solving ability is in addition to other assumed benefits, learning efficiency does not play as important a role.

Another important issue is given the fact that LOGO programming does in fact increase systematic thought, is this effect desirable? LOGO appears to be an obvious answer to what Piagetians term the "American question", which asks if it is possible to intentionally hurry children through their developmental stages. Papert has speculated that if computers and programming eventually become part of the cultural fabric, that one consequence might be that children's cognitive development might be hastened, especially between the concrete and formal operational stages (Papert, 1980). Regardless of the answer to this "question", one should consider David Elkind's (1981) interpretation of childhood where ". . . it is important to see childhood as a stage of life, not just as the anteroom of life" (p. 199). Each stage should be given equal value in the development of the being, rather than merely interpreting cognitive development as a "race" to be won. The responsibility of research is to investigate these speculations in order to provide objective ways in which to make appropriate decisions, whether instructional or societal, on the behalf of the individual.

Implications for Future Research

In contrast to Papert's criticisms of experimental research involving LOGO as a treatment variable, several recommendations for future research are to be made. The first concerns the possible treatment interactions involving the learning environment in which LOGO is presented to children. Considering the results presented here as well as the findings from the Bank Street College of Education, the University of Israel, and the University of Edinburgh, it is implied that LOGO's success is heavily dependent upon the learning context. This learning context would include the physical elements such as the number of computers and the time on task, but most importantly the basic method of interaction such as free discovery, guided discovery, or highly structured. Future research should center on the effects that these different LOGO learning contexts have on the child's cognitive growth. Certainly, future research should also consider the individual learner characteristics and the role that these differences play in determining the proper LOGO environments.

It has been pointed out that there presently exists a unique opportunity for computer education research (Lepper, 1985). As computers begin to become a part of our daily lives, it will be difficult to find subjects who have not had prior computer experiences. Without such subjects, finding an appropriate control population will not be possible. This fleeting computer "research window" could be viewed as similar to the history of research in educational television. The obvious conclusion is that researchers need to act upon this research opportunity before it disappears.

This study has raised several questions concerning the learning effects of LOGO on young learners. It is hoped that further research will continue to clarify situations where using LOGO is appropriate as well as inapropriate. Most importantly, more research appears warranted and needed in this realm of computer education.

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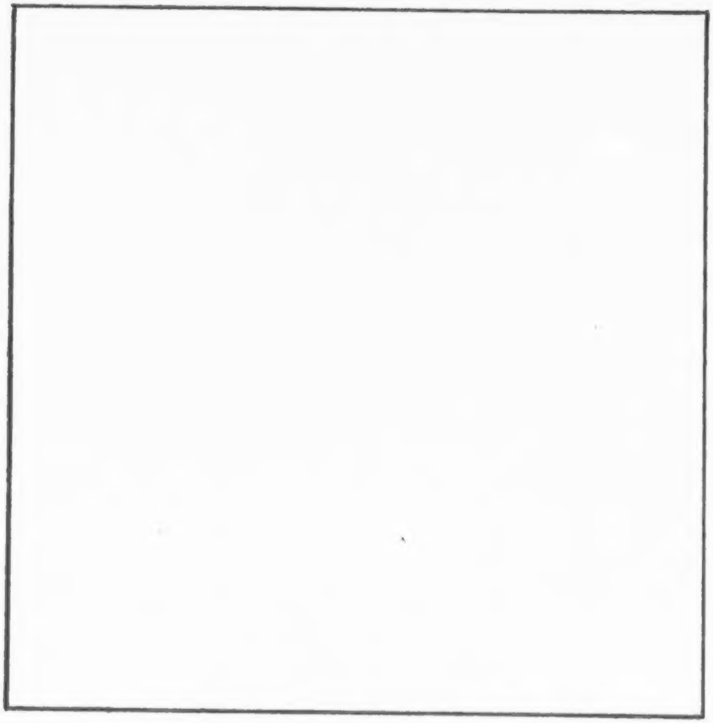
Table 1. Descriptive Statistics of Treatment Groups

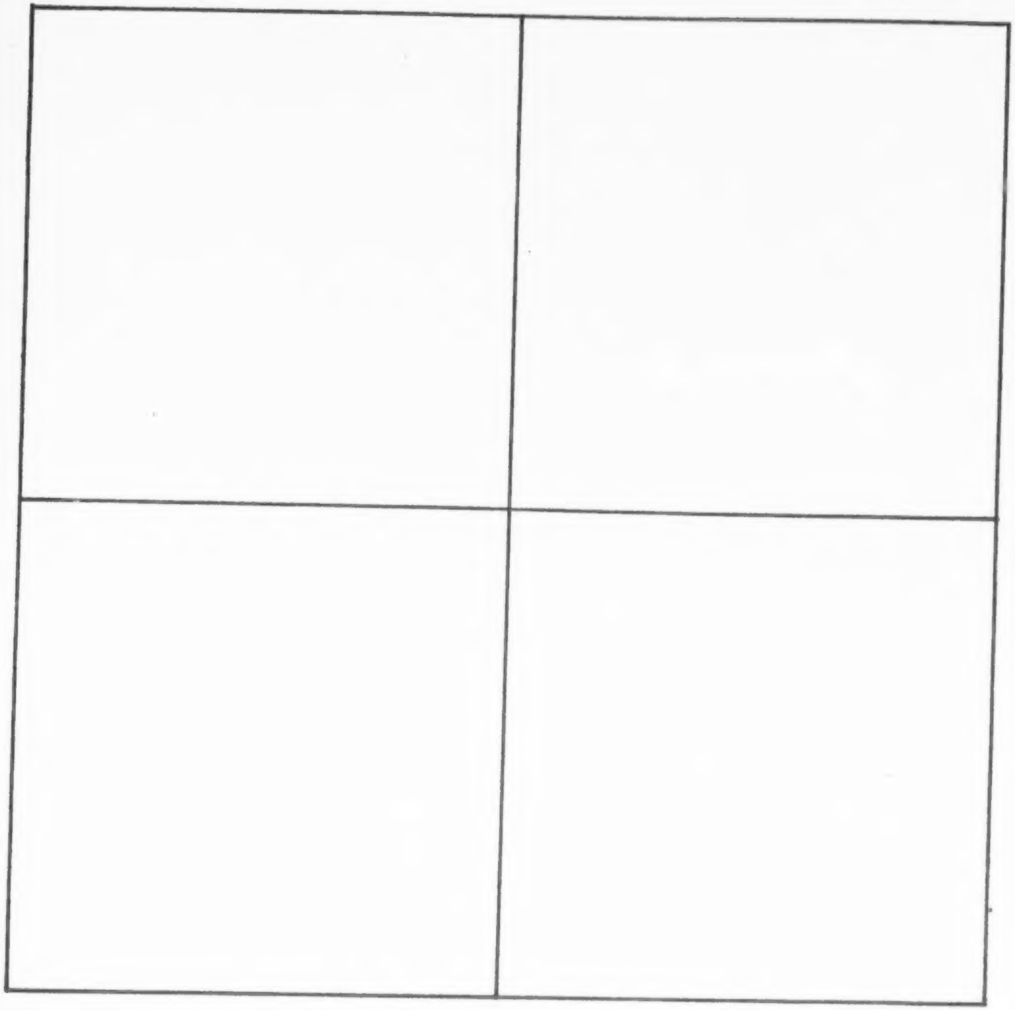
	Experimental	Control
Number of Subjects	25	22
Problem Solving		
PRETEST MEAN	11.52	11.27
(SD)	(5.92)	(4.55)
POSTTEST MEAN	17.6	10.59
(SD)	(5.11)	(4.45)
Geometry Test		
PRETEST MEAN	11.4	11.73
(SD)	(2.57)	(3.01)
POSTTEST MEAN	14.8	12.5
(SD)	(4.88)	(3.56)

APPENDIX I

SQUARE

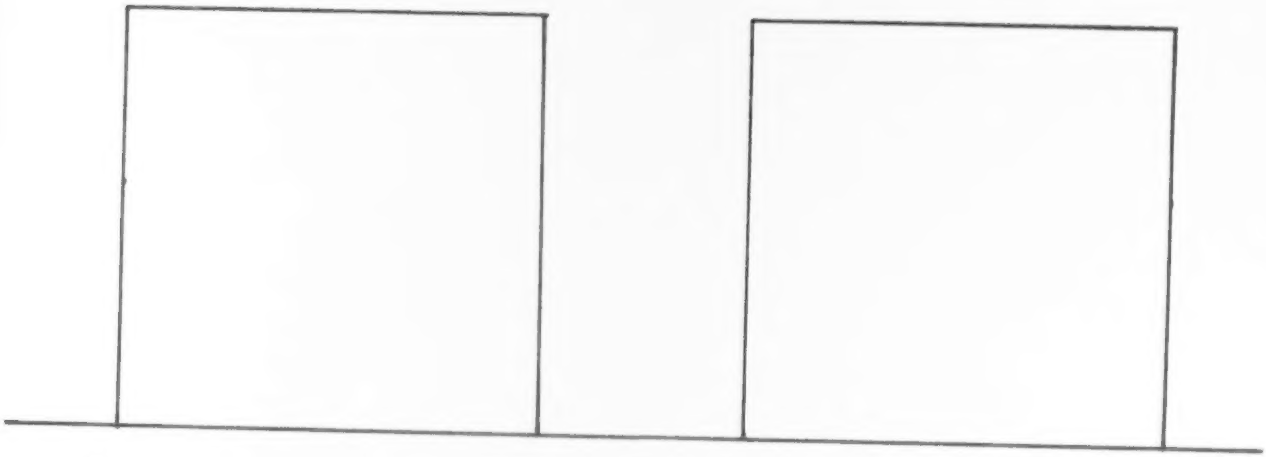
All 4 sides are equal.
All 4 angles are equal.

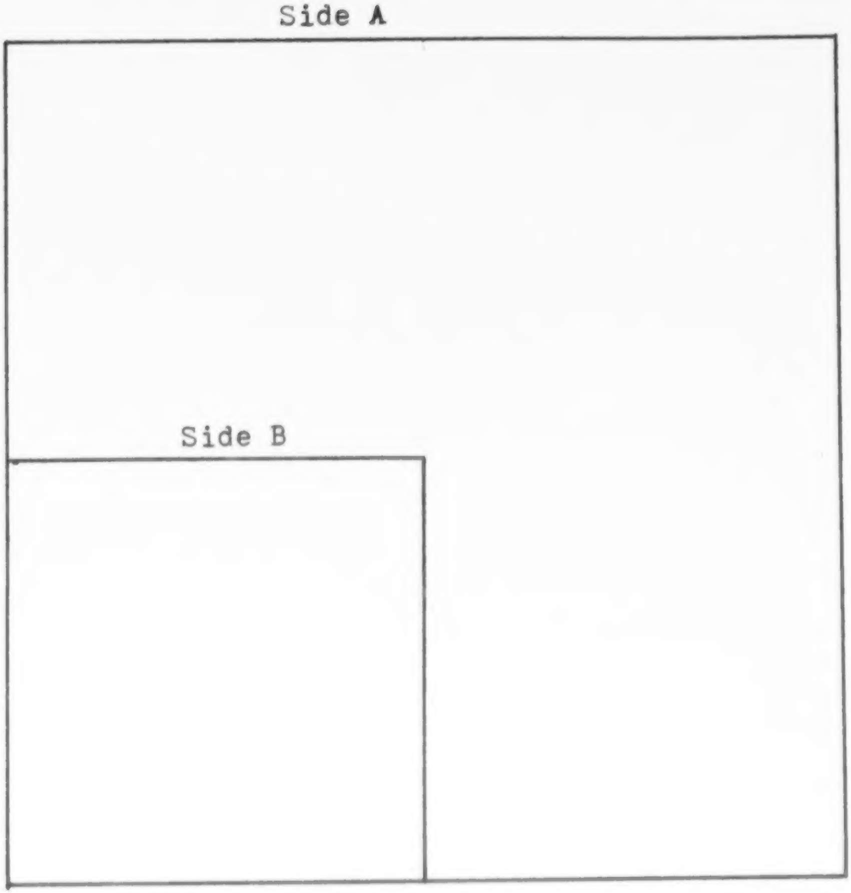




The 4 little squares
make 1 big square.

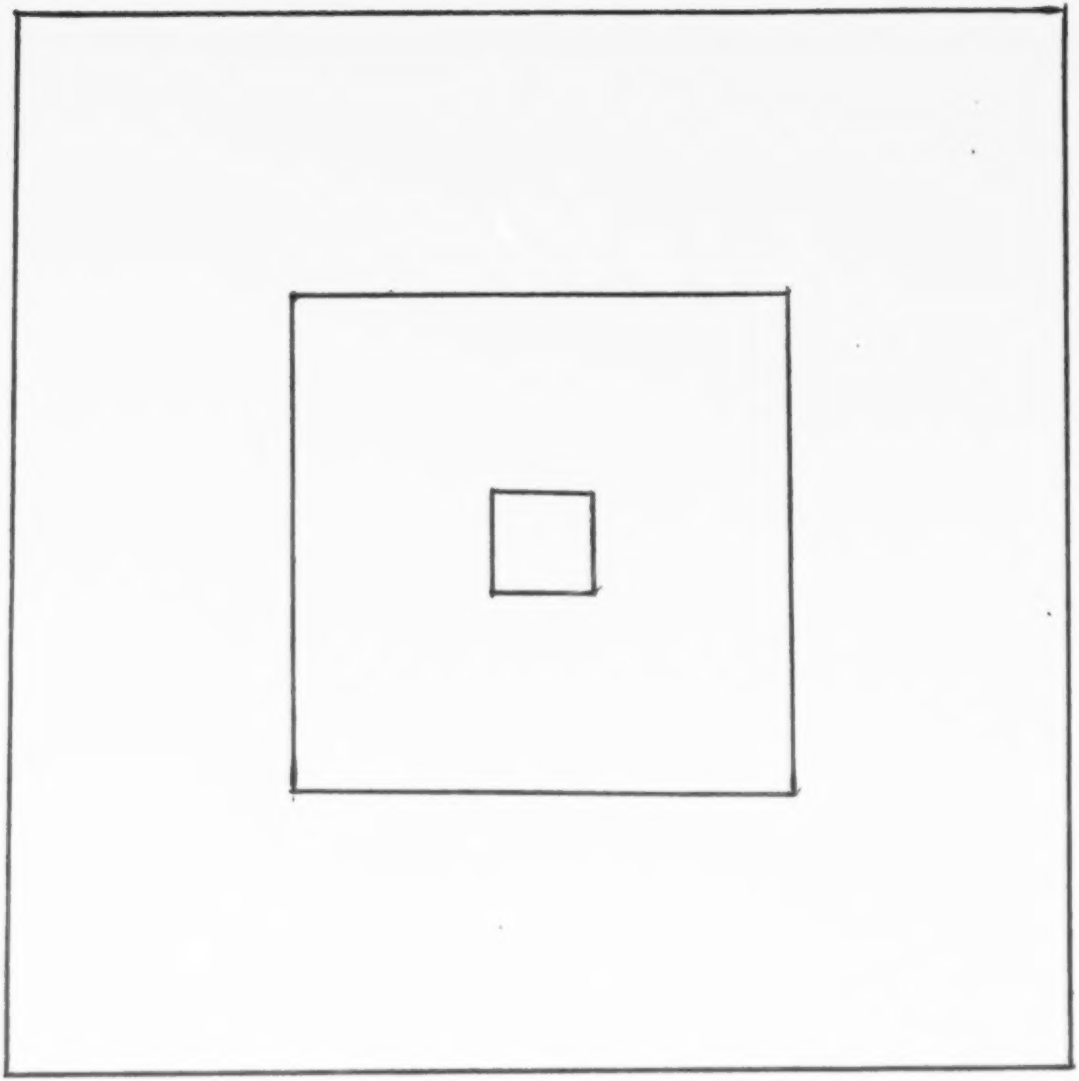
Both squares are exactly the same size.



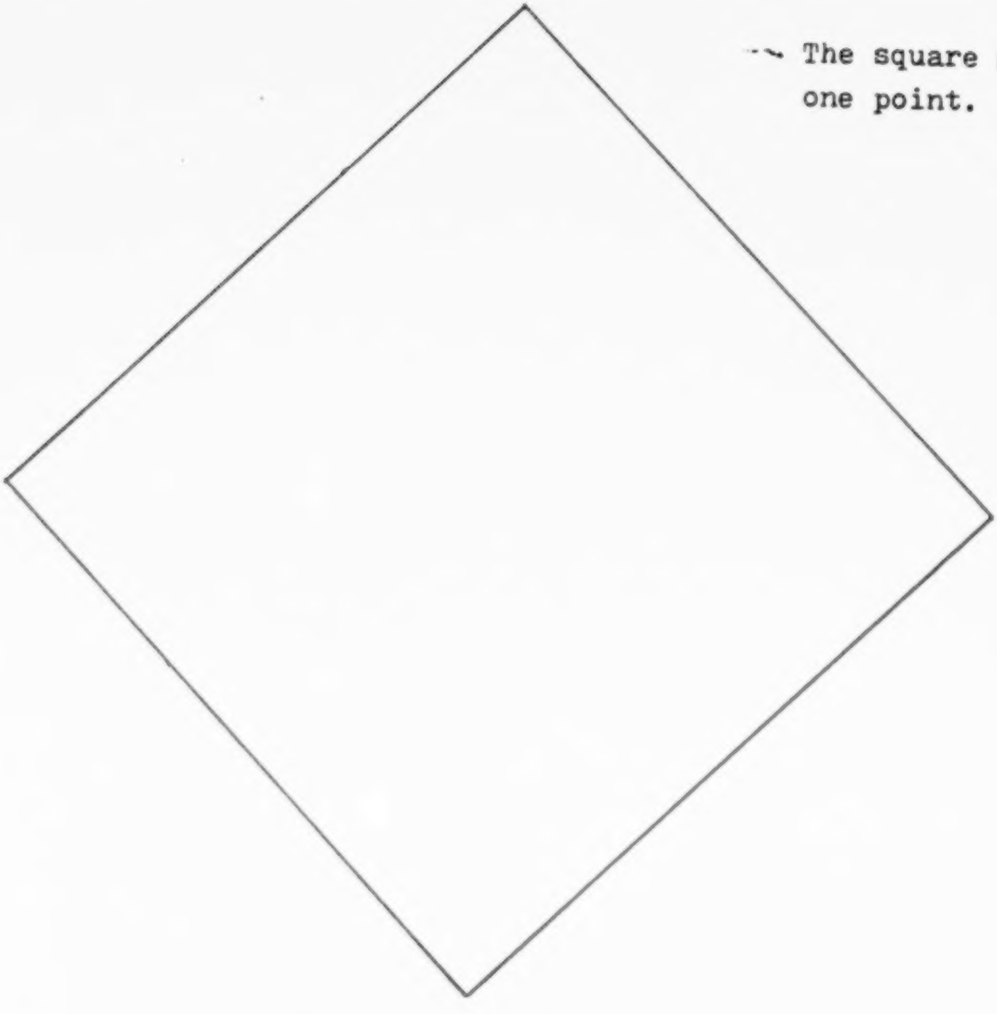

Side A
Side B

Side A is exactly twice as long as Side B.

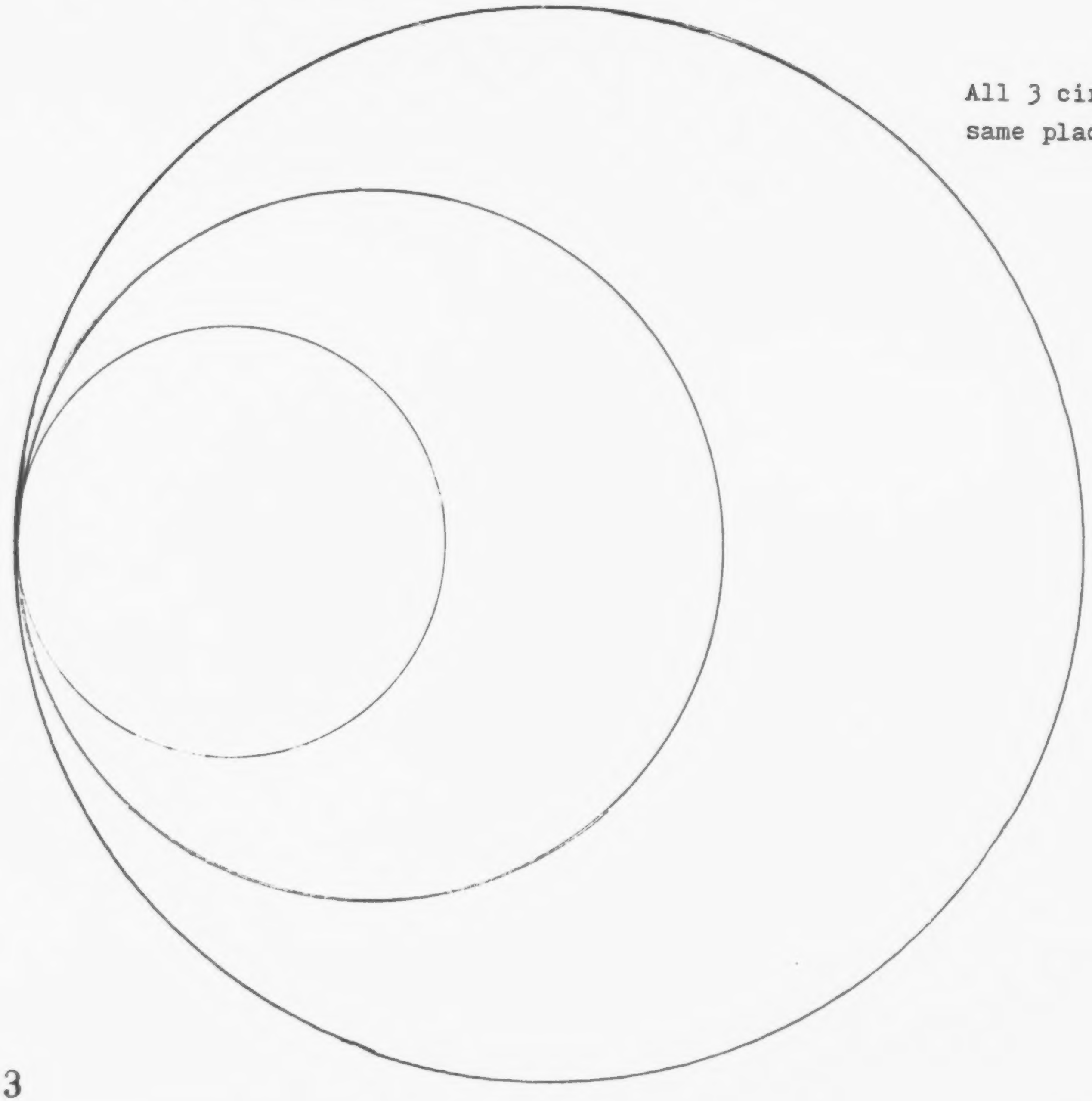
All 3 squares have the same middle.



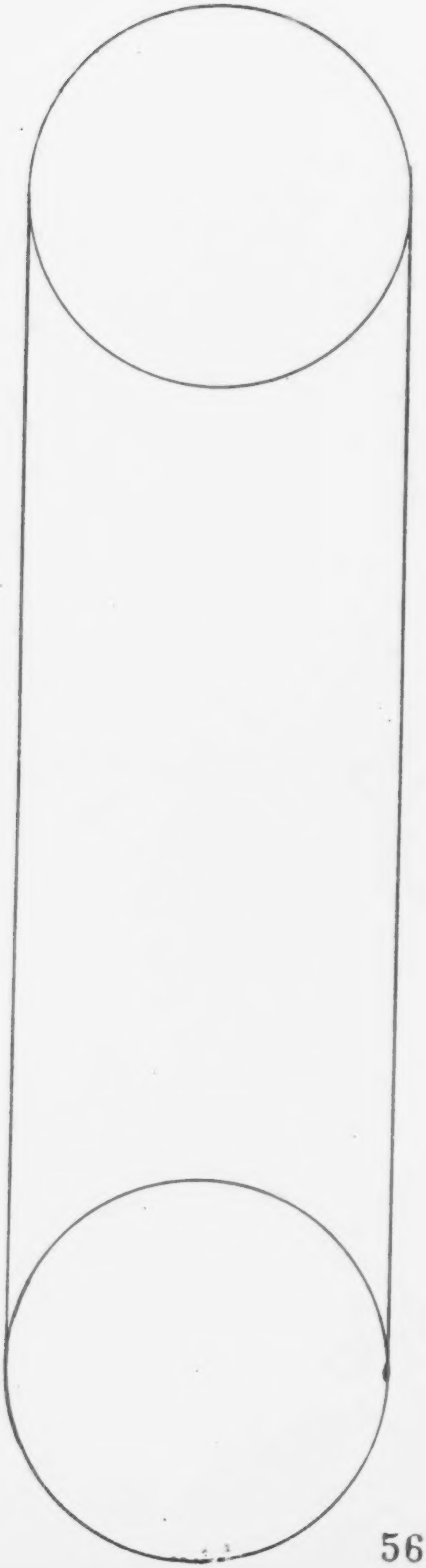
DIAMOND



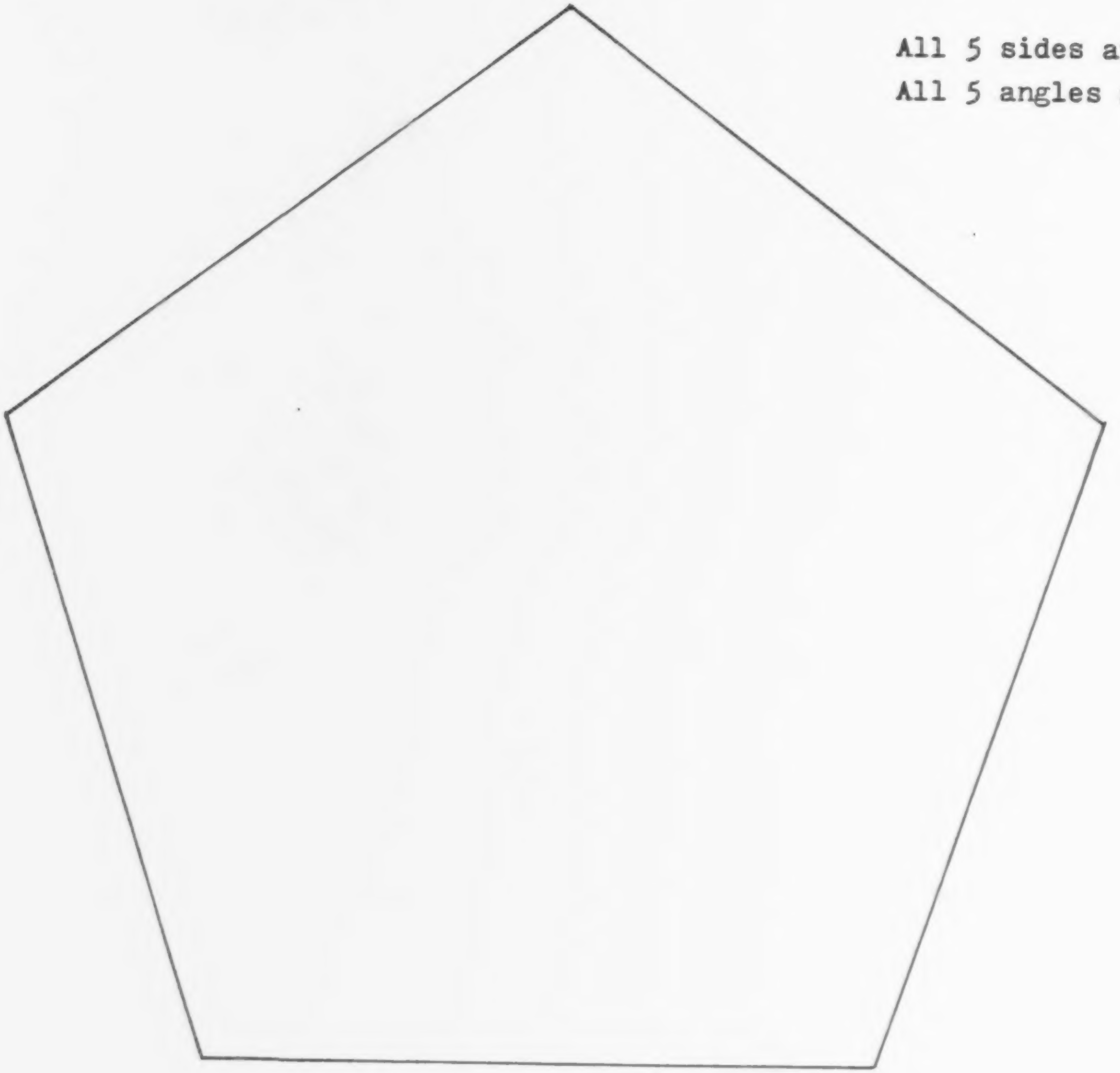
~ The square must rest on one point.



All 3 circles touch at the same place.

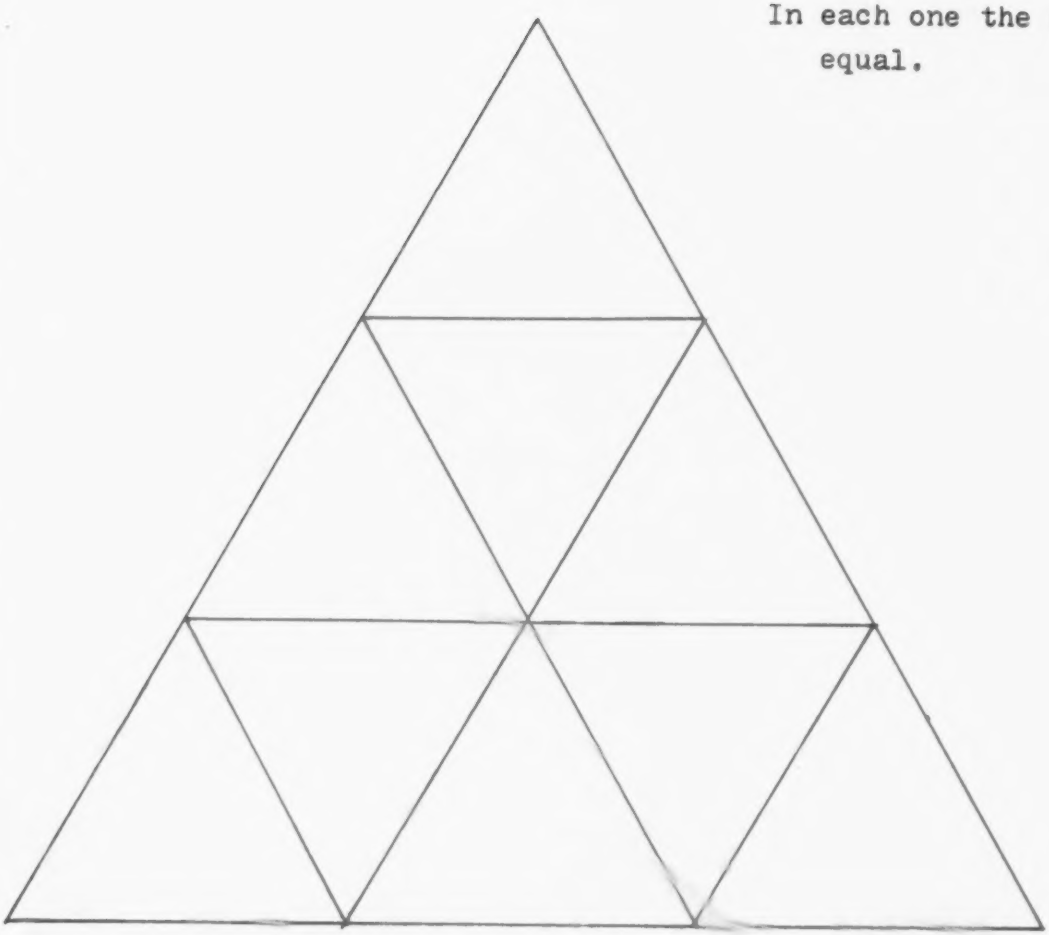


PENTAGON



All 5 sides are equal.
All 5 angles are equal.

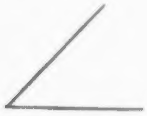
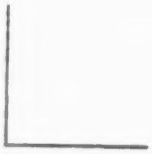
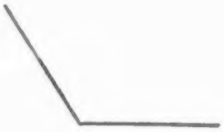
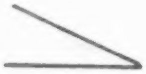
All 9 small triangles are identical. In each one the sides and angles are equal.



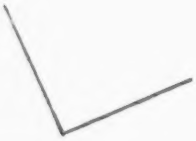
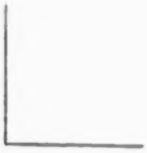
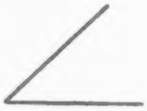
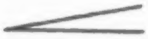
APPENDIX II

Name ______________________________ Age: Yrs. ______ Mo. ______

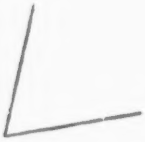
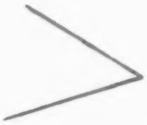
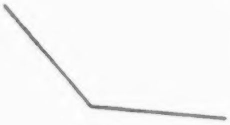
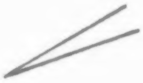
1. Circle the 90° angle.

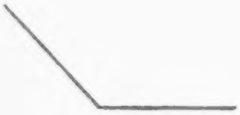
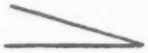
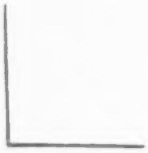
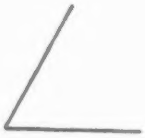
2. Circle the 45° angle.

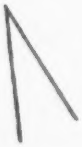
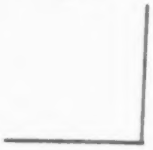
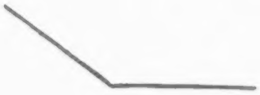
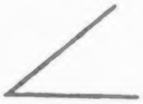
3. Circle the 10° angle.

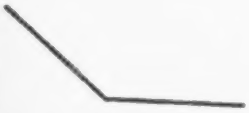
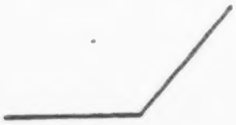
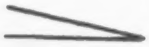
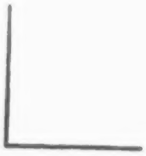
4. Circle the 135° angle.

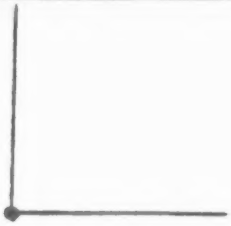
5. Circle the 270° angle.

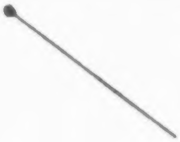





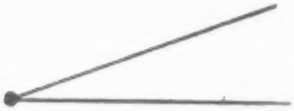
6. Circle the 350° angle.

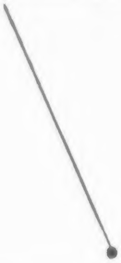





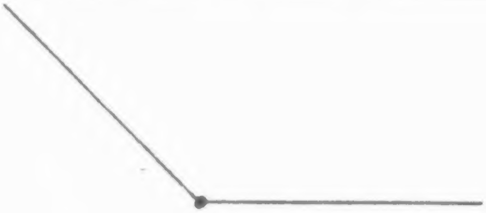
Finish drawing these angles so that they match perfectly the angle already drawn.

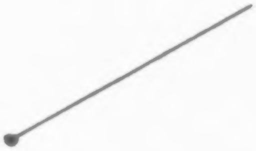


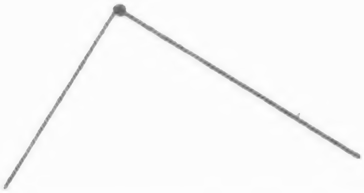


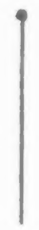


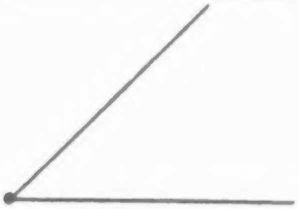


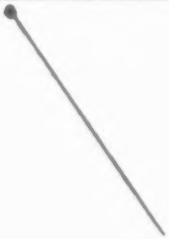


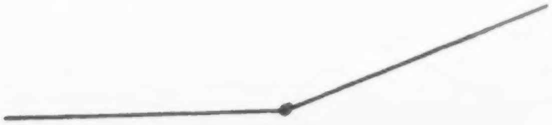


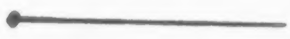












Finish drawing these lines so that they are exactly the same length.

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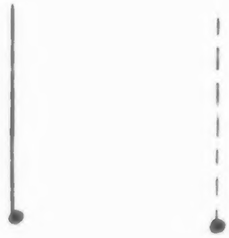

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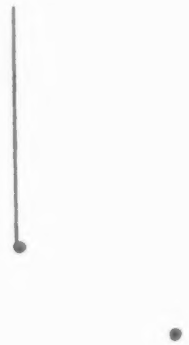

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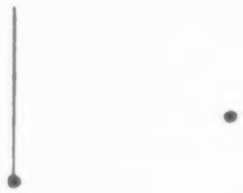

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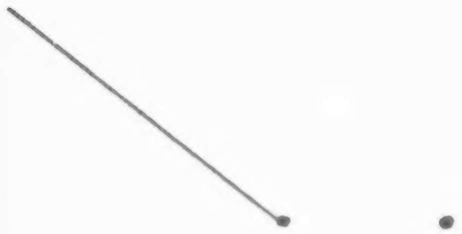

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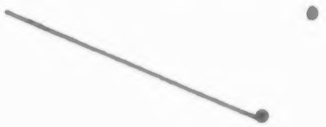

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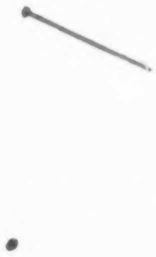

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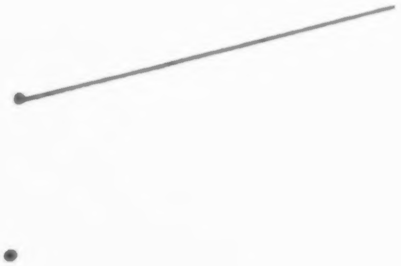
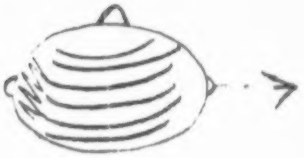
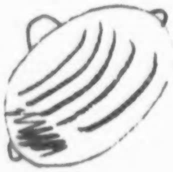
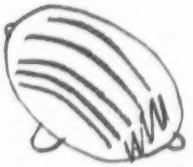


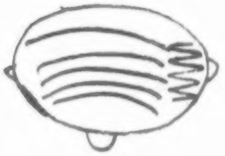
Spin Oscar 90° to the right.

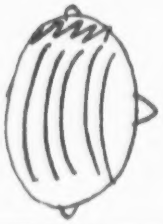
EXAMPLE:

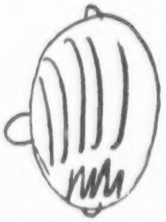




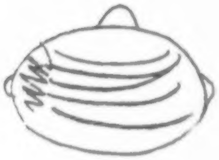


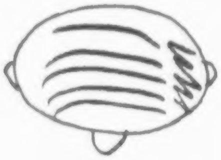


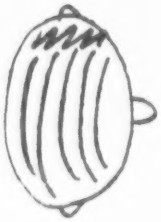


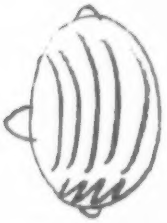


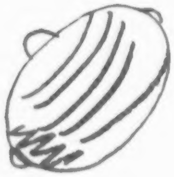
Spin Oscar 45° to the left.

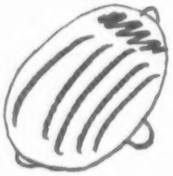




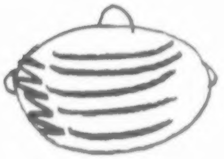


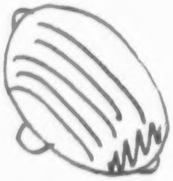


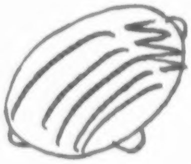


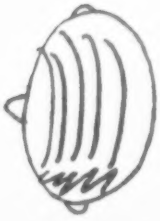


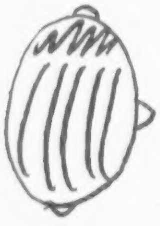
Spin Oscar 180° to the right.

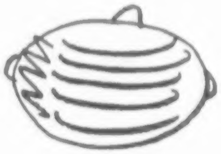












Interactive Cable Television:
An Evaluation Study

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Interactive Cable Television: An Evaluation Study

Rhonda S. Robinson and Peter C. West
Northern Illinois University

Background

Educators are taking advantage of new opportunities to expand or improve education through cable television and microwave technology. Telecommunications can extend the classroom and learning potential for hundreds of students. Teleconferencing, one use of telecommunications, has become viable for education, training, and business meetings both in education and business and industry. Teleconferencing is a dynamic, live, interactive process which allows students in different locations to communicate and participate in an interactive educational experience (Olgren and Parker, 1983). Interactive television is one form of instructional television which has proved to be an effective and popular medium of instruction, more so than the ITV programs first introduced in the 1950's (Bloom, 1984).

There are many critics who "believe that education is the only major American industry which does not yet make intensive use of modern technologies to reduce its costs and to increase the scope of its services" (Curtis and Biedenbach, 1979, p. 3). Several interactive television projects around the country have begun to utilize technology in an innovative yet practical way to increase the overall effectiveness and availability of educational opportunities in their communities.

A project begun in Illinois in August, 1983 is an attempt to utilize new and emerging technologies to increase the effectiveness of the educational process. This project, the Carroll Instructional Television Consortium, was the first cooperative educational program of its kind in Illinois, and was born of the common need of four small rural high schools to offer a full range of academic opportunity to their students. The Consortium utilizes a cable television network already serving the four districts. The system permits simultaneous video and audio communication between any or all of the four high schools. The two-way television consortium represents a technologically acceptable method for sharing instructional resources, better utilizing faculty expertise and more fully serving the academic needs of students.

The project goals of the Carroll Instructional Television Consortium are:

1. To increase the total number of course offerings available to students enrolled in the participating districts.

2. To provide fully qualified, experienced, and effective faculty to teach advanced level course work in mathematics, science and foreign languages.

3. To motivate and challenge talented and gifted students through association with comparable students from other districts.

4. To promote high levels of student achievement as measured by content mastery of advanced level course work.

5. To increase the efficiency of teacher instructional time in traditionally low enrollment advanced level curricular offerings.

Based initially on these goals, project evaluation was designed as a five year process. The research has broadened some to include many factors of the environment, and to be as complete as possible.

Project evaluation of this scope has many inherent problems. The subjectivity of observation, the lack of control of population or teaching methods, the gaps in communication or cooperation all prevent the researchers from utilizing experimental research procedures which could add more data to comparative studies literature. Instead, the design of this research was based on naturalistic research premises; the outcomes will be non-statistical but rich data about the school environment and the project's success. This study employs a naturalistic paradigm to investigate a technologically innovative project using two-way interactive television as a vehicle to enhance curriculum.

Although this is a fairly recent technology, some studies have reported on utilization of interactive television instruction. Interactive television has been successfully integrated into education systems and is a cost-effective means of augmenting the quality of education available to students, especially in rural areas. This instructional technology increases the spectrum of courses available in small school districts and offers an alternative solution to consolidation of the school districts (Holt, 1985). It is a means to developing an educational system that "substantially expands and increases high school curriculum" (School Tech News, 1985). Microwave and cable transmission of two-way video provide students from surrounding school districts with the opportunity to enroll in courses which otherwise would have been available to only one school due to a shortage of specialized instructors. Advanced levels of foreign languages, science and mathematics are high school courses typically offered. Sharing of subject matter experts eliminates the need for students to be transported to a central location, or for the instructor to travel to all of the sites (Schramm, 1977). Interactive television (ITV) is also economically feasible because the expenses incurred are shared cooperatively by the school districts involved in the program, and many of these expenses are non-recurring (Pate, 1985). It is most economical to connect the videoconferencing system with an existing cable television network (Howe, 1984).

Courses taught by ITV have been well received by participants, as evidenced by annually increasing enrollment in the courses and an increase in the number of course offerings to accommodate this need (Jones, 1985). Two-way television has been used extensively in school districts throughout the country, and with a high degree of success (Jones, 1985). Microwaves for Learning in Iowa, Communicasting for Educational Purposes in Minnesota and the Irvine project in California, are a few examples cited by Jones. No significant difference in test scores resulted when a College Learning course was taught either in-person or by interactive two way television (Johnson, O'Connor an

Rossing, 1984). Survey results also revealed no negative attitudes regarding the instructional strategy utilized. Graduate students studying supervision via interactive two-way television had positive attitudes about the mode of instruction and learned equally as well as the control group (Johnson, O'Connor, Rossing, 1984).

Though the technology utilization has been studied only recently, these studies revealed a high degree of interest in both the effecthveness of interactive systems and in participants' attitudes towards learning from such systems. Project reports from Trempealeau County Wisconsin and from Texas A & M (Johnson, O'Connor, and Rossing, 1983) show preliminary success. The Carroll I.T.V. Consortium modeled itself in part after the Trempealeau County project. Evaluation reports from Wisconsin were available in the design of the research for this project.

Objectives of the Study

This paper explains the research being conducted to evaluate the project, and the results evident from data collected to date. This study was designed to determine:

1. Is an interactive television system effective?

2. Is the teaching/learning process affected by use of interactive television?

3. Is the interactive television system accepted by the teachers, the students, and administrators?

4. Are the project goals successfully met?

Method

A case study was designed to intensively study the status and interaction of the participants and this project. Data is being collected using several different techniques:

1. Student cognitive growth is measured by pre- and post-tests in their subject matter.

2. Students are surveyed four times during the year to evaluate technical aspects of the system.

3. Teachers are observed throughout the year, approximately 75 hours in total.

4. Administrators involved in the innovation are interviewed about their decision-making process and their satisfaction with the project.

The case study methodology includes many separate data collection techniques, as listed. More specifically, evaluation and data collection includes:

1. A comparison of 1984-85 course offerings with 1983-84 course offerings in each participating district by the district administrator and researcher.

2. Periodic assessments of teacher effectiveness by district administrators and the researcher.

3. A survey of student opinions about teacher effectiveness conducted by the researcher during each quarter of the academic year.

4. A survey of student attitudes and satisfaction conducted by the researcher during the fourth quarter of the academic year.

5. A survey of teacher opinions about student motivation and degree of challenge conducted by the researcher during the fourth quarter of the academic year.

6. Teacher-made tests covering learner objectives identified in course outlines utilized for entry and exit level assessments of student mastery of course content.

7. Analyses of student achievement scores made by the researchers to assess: 1) student growth, and 2) comparison of achievement scores for students located at originating site with those located at remote sites, and with those not in TV classes where available.

8. A comparison made by district administrators of enrollments in the televised classes with enrollments in the same classes taught in individual district during the previous two years.

Thus, the data collection has been triangulated to include pre- and post-tests, student/teacher surveys, and observation and interviews throughout the project. Guba (1981) suggests that triangulation can improve dependability and transferability of data collected in naturalistic inquiry. The trustworthiness of observation and interview data can be enhanced by the collection of survey and cognitive growth data, and by the comparison of results gathered by all three methods. Further explanation of each data source is available (Robinson, 1985).

Results

This study has been designed to evaluate and assess the use of interactive cable television as an alternative method of delivering courses. Once study objectives were established it was then necessary to attempt to determine if those objectives were being met. The results reported here are based on the second year of this five year project.

The first objective was to determine if a two-way interactive television system would be effective. Previous studies have been done on interactive television, but many of those studies examined systems that were one-way video, and two-way audio. This study has examined an interactive system that is two-way audio, and two-way video.

In order to accurately assess the effectiveness of this interactive systems pre- and post-tests were administered. The pre-test was administered to assess entry level skills and abilities of students. The post-test provided data which indicated how well students learned course material. These tests were given to students in all classes taught over the system. Additionally, if a class being taught over the system was also being taught in the traditional manner in one or more of the schools, the same test was given to students in those classes as well. The courses offered over the system were math IV, shorthand, Spanish I and II, and chemistry. Preliminary results have shown that among students taking courses over the system, those students in distant schools are scoring as well as students in home schools (where the course originates). Since many of the classes are small (some have as few as 4 students), comparative statistical analysis is not as valid at this time as it will be at the end of the five year study.

For 1984-1985, a comparison of mean post-test scores has been completed. The post-test score for students in the home school for Spanish II was 171.3 while the mean post-test score for students in that class at the remote school was 193.33. The chemistry class produced similar results: the mean post-test score for the home school students was 33.5; for the remote school students it was 36.43. These two classes demonstrate that students in the remote classes scored a bit better. On the other had, home school students in the Math IV class scored somewhat better than students in the remote schools. Post test mean scores for students in the home school were 91, while mean post-test scores for student in one remote school were 75, and in another remote school were 66.88.

Just as significant is the fact that students enrolled in courses over the interactive system perform almost as well as students enrolled in the same class taught in the traditional setting. One example of this is the Spanish I class. Students in the interactive Spanish I class had mean post-test scores of 206, while students in the traditional Spanish I class had mean post-test scores of 231.

The second study objective was to determine if the teaching/learning process is affected by the use of interactive television. While it is true the term "teaching/learning process" can sometimes be an ambiguous concept, for the purposes of this study it has been defined as any activity associated with the teaching process (i.e. lecturing, class discussion) and any activity associated with the learning process (i.e. class participation, teacher accessibility, interaction with classmates, etc.). Based on the responses to questions on a survey administered four times each year (see Appendix) students reacted positively to the system. Their responses indicate a high degree of satisfaction with these courses.

The students do not feel the technology interfered with the teaching/learning process. 93% report the video reception as good to excellent; 87% indicate they can hear the instructor and students in other locations without any problem; 75.9% thought the talkback feature did not interfere with their ability to communicate with students in other locations; 78.7% report no problems with having access to the instructor after regular class hours; 89.8% report no problems with receiving handouts, tests and other items in time for assignments; and finally 85.6% believe material in the interactive class is as easy to follow as it is in a regular class. The biggest problem with the interactive system is that it does not really allow students to get to know their classmates from the other schools. 75.4% indicated they had little opportunity to interact with students from other schools.

In over 100 hours of observation, it was noted that the biggest obstacle to the teaching/learning process was "downtime." Because of factors beyond the control of the students or the teachers (i.e. weather, technical difficulties, audio interference) there were times when no instruction was being provided.

The third study objective was to determine if the system would be accepted by the students, the teachers, and administrators. Again, information was collected using students surveys, interviews with teachers and administrators, and observations of classes. 80.1% of the students surveyed gave the system a rating of average to excellent. Only 19.9% reported dissatisfaction with the system. Initial interviews with teachers revealed most had mixed feelings. The teachers expressed fears about being replaced by technology (unfounded), and fears about technology in general (overcome by in-service training). The majority of teachers interviewed agreed that a system such as this was needed to begin offering classes that would not otherwise be offered. In addition, they saw it as a means for increasing student enrollment in their classes.

The fourth study objective was to determine if project goals are being successfully met. As stated earlier, the goals of the project are to:

1. Increase the total number of courses offered.

2. Provide qualified, experienced and effective faculty to teach advanced level courses in math, science, and foreign languages.

3. Motivate and challenge talented and gifted students.

4. Promote high levels of student achievement as measured by content mastery of advanced level course work.

5. Increase the efficiency of teacher instructional time in low enrollment advanced level courses.

Based on research collected to-date through observations and interviews, all of the above goals have been met, and in some cases surpassed. Students are now receiving courses they would not otherwise have had. This has been particularly true in the math, science and foreign language areas. Because the system allows the schools to offer these advanced level courses, talented and gifted students now have an opportunity to work with comparable students from other districts. The only project goal which has not been fully met is to increase the efficiency of teacher instructional time. Because of occasional equipment start-up problems, and inter-district scheduling conflicts, teacher instructional time has not been positively effected.

Discussion

Since the 1940's, educators have looked to technology to revolutionize the education process. However, education has been slow to adopt technology, and that technology has not brought about the sweeping changes once anticipated. Even though millions of dollars have been spent, the results have been disappointing (Prange, 1973).

Interactive television instruction projects such as the Carroll Instructional Television Consortium are an example of the successful use of technology for education. They are not, however, a panacea. There are inherent problems which are possibly unsolvable, but which do not negate the positive effects.

For example, not all students will find learning via technology to be conducive to their learning style. Not all students in interactive television classrooms feel comfortable learning from a "distant" teacher, nor do they feel that they get an opportunity to know classmates in other schools. While teachers have developed techniques to encourage participation, and have provided opportunities for students to get better acquainted in person, these are only partial solutions. Interactive television systems can not eliminate the problems of geographic distance.

In addition, the technology itself is not perfect. Any time technology is involved, the learning process can be interrupted. There will always be problems with atmospheric and external interference. In this project, the cable system can be rendered inoperative by snow, interference from C.B. radio or other low band audio broadcasts, or by cable or power outages. While a two minute breakdown in audio contact may not sound like a technical problem, it certainly has proven to be for the teachers trying to encourage participation between distant schools.

The strengths of this study are its longitudinal design and its triangulated data collection. Instruments utilized are similar to other studies on interactive television projects (Holt, 1985; Johnson, et. al, 1984). To date, after 2 1/2 years of data collection, results have tended to indicate that the two way interactive system can be used successfully in the educational process. Johnson, et. al. (1984) and Brad Winchell of the East Central Minnesota Educational Cooperative have found similar results (School Tech News, 1985).

The data from this study has also revealed a fairly high level of satisfaction with the system, and positive student attitudes. These results are similar to those reported by Johnson and by Denton, et. al., (1985). In its evaluation of the project, the study objectives have been similar to other projects, and have reported similar results.

While interactive cable television instruction is still a fairly new technology, the research is beginning to indicate that systems can be effective, cost efficient, and viable alternatives to live instruction. The benefits, problems, and drawbacks need continued research before a definitive statement can be made about this technological solution to an educational problem.

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Appendix

CARROLL INSTRUCTIONAL TELEVISION CONSORTIUM

Student Survey
1985 - 1986

Your School ______________________________

Instructor ______________________________

Course ______________________________

Did you take a TV course last year?

☐ Yes

☐ No

****

Please rate the following questions on a scale of 1 - 5 (1 = poor, 2 = below average, 3 = average, 4 = above average, 5 = excellent), and make any additional comments you care to.

1. What was your opinion of the TV classes before this class?

   ☐ no opinion ☐ poor idea ☐ average idea ☐ above average idea

2. Why did you have that opinion? ______________________________

   ____

3. Is the reception of the picture good enough for following the lecture, copying materials, and taking notes? _____ (1-5)

4. Can you hear the instructor, and the students in the other schools? _____ (1-5)

5. Do you feel that the talkback feature allowed you to participate as effectively in this class as in regular classes? _____ (1-5)

6. Do you feel as comfortable learning from the TV teacher as you do from a teacher in a regular class? _____ (1-5)

7. Is the teacher accessible to you outside of regular class time? _____ (1-5)

   Please describe when and how the teacher is accessible to you.

   ____

8. Do you feel you have an opportunity to get to know your classmates from the other schools as well as you get to know your classmates in a regular class? _____ (1-5)

9. Have you been receiving hand-outs and other materials from the teacher in time for assignments? _____ (1-5)

10. Do you feel the material presented in this class has been as easy to follow as material presented in regular classes? _____ (1-5)

11. How well do you like the TV class? _____ (1-5)

12. In general, how well do you like school? _____ (1-5)

Are there any additional comments you would like to make?

WHAT YOUR PROFESSOR NEVER TOLD YOU ABOUT THE MUNDANE PRACTICE OF INSTRUCTIONAL DESIGN

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Introduction

Graduate education provides students with access to our proud and varied theoretical underpinnings. There is communications theory; media research; information systems; motivation theory and behavioral and cognitive psychology. At the university we enjoy Merrill and Reigeluth; Gagne and Briggs; Markle and Tiemann; Fleming and Levie; Cronbach and Snow. But in the field, when a training professional is asked what references he or she wants to take to the moon, it's Robert Mager and.... the bible. No kidding, that's what a major national survey found.

This presentation briefly reviews some hallowed research and theory **traditions**, ones I too have shared with generations of students. Then we will look at what is **actually happening** in the field. My experience in corporations, agencies and schools and a recent national survey suggests that the real world practice of instructional design bares only a kissing cousin resemblance to the chapters of Dick and Carey.

Textbook Instructional Design

The literature offers no end of suggestions for the systematic and effective development of instructional products and services. This is just a brief and partially attributed listing:

- There are scores of models, with endless arrays of boxes and arrows.

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- Most proponents of the models share belief in needs assessment; articulating behaviorally stated objectives; using objectives to determine strategies/media and evaluation criteria; and actually carrying out some form of assessment to determine if the product or service solved the initiating problem.

- Most of the models differ in allegiance to behaviorist or cognitivist perspectives, with some writers going so far as to sound a death knell for instructional development if we refuse to throw off our behaviorist shackles. (Low,1981; Sprague, 1981, etc.)

- Presumably, the particular theoretical underpinnings make a significant difference in the practice of instructional development.

- The details of instructional design (for example, the development or classification of objectives a la Mager or Gagne) matter.

- Writers and researchers in instructional development and educational technology herald the dawn of an era of CBT and interactive video/videodisc. (Refer to issues of Educational Technology or The Journal of Technological Horizons in Education.)

- Our literature and conferences suggest great interest in authoring systems and languages which enable subject matter experts and classroom teachers to design CBT without being programmers themselves.

- Graduate education is a valuable undertaking.

The Practice of Instructional Design

I have taught instructional design for nearly a decade. I've taught it to graduate students at the University **and** to course developers and training specialists in settings as diverse as telephone companies, banks, 7-11 training centers, and the United Way. I've had hundreds of discussions with instructional designers and their managers about what they do do, what they are expected to do, and what they wish they knew how to do.

TRAINING magazine's October 1985 census issue adds a splendid data base to my experience. This past summer they surveyed thousands of training professionals. I'm convinced that this survey provides us with a credible picture of current practice-- not the way it **ought** to be-- but certainly the way **it currently is in the cubicles across the nation where people who call themselves designers, developers, trainers, education specialists and educational technologists labor.**

- There is little talk about instructional design models in the field. Most training departments fight fires, responding to needs and issues initiated by others. It is hard to find the time to cogitate on Florida State's or Michigan State's model when the Director of Data Processing is breathing down your neck with a request for a new course.

- The TRAINING study did, however, find something which supports the potency of systematic approaches to training and development. They asked repondents to respond affirmatively or negatively to these two questions: "We're too small to justify ISD;" and "Management wouldn't stand still for ISD." If respondents said yes to either, they were much more likely to report that training was less important in their organization now than it was two years ago. If they said no to both or either, they were 4 times as likely to report increased budgets! Ron Zemke's commented, "Those who practice a systematic approach fare better in their organizations."

- Have you ever for a moment doubted the omnipresence of objectives and evaluation in the real world of instructional development? The **good** news is that more than half of responding professionals in the TRAINING survey say they do indeed....

☐ write objectives in behavioral terms
☐ assess entry level skills and knowledge
☐ base media and method decisions on objectives
☐ test programs as they are developed
☐ evaluate the effectiveness of programs
☐ use feedback and test performance to revise

But the **bad** news is that the percentages responding affirmatively are so low.

- ☐ write objectives in behavioral terms (60%)
- ☐ assess entry level skills and knowledge (64%)
- ☐ base media and method decisions on objectives (78%)
- ☐ test programs as they are developed (65%)
- ☐ evaluate the effectiveness of programs (65%)
- ☐ use feedback and test performance to revise (87%)

If practitioners write objectives only 60% of the time, how often do you imagine that they classify them? Or use those classifications to make decisions? Or discuss the distinctions between Mager, Merrill and Gagne--with their implications for instructional design?

- Seventeen percent agreed to the statement, "Our organization is too small to justify the processes and procedures implied by the above items." And 29% said yes to, "Our management would never stand still for our taking the time to follow the processes and procedures implied by the above items."

- News for the front end analysis fans: not even 40% report conducting needs assessments and task analyses! Forty-seven percent do discriminate between training and non-training needs.

- Theory is of much more interest in the academy than it is to the practitioner. Only in the largest of corporations or agencies (e.g. the military or AT&T) is there support for discussion of the theoretical bases for instructional development standards and guidelines.

- Cognitive psychology and motivation theory are making small, slow inroads into the practice of instructional design. Large corporations, often in the telcommunications and transportation industries, and the military services, are reworking their standards and guidelines to include new perspectives and accomodate new technologies.

- The vast majority of computers that are available in industry and agencies are used for data management and word processing **not CBT. In 1985 computers are more likely to be used for instructional purposes in the public schools than they are in corporate America.**

- The TRAINING survey found that we are still a long way from CBT in every corporation. In 1985, 27% of respondents report using CBT or CBI. When CBT is used, it is used to teach about computer related topics. Computers are only rarely a means to provide training for non-computer topics like leadership or basic sales skills.

- Instructional interactive video and videodisc, all the rage at San Diego State, is just beginning to have an impact on the field. Just under 12% of TRAINING's respondents report hooking a computer up to video or a disc player for training. Interactive **videodisc,** the most promising of those delivery systems, is being used in fewer than 3% of the settings.

- Graduate education has mixed impact. Post graduate certificates and master's degrees bore no statistically significant relationship to earning power. The doctorate did, adding $4735 to annual earnings.

- Training professionals acknowledged the significance of graduate education by ranking formal education second, after OJT, as a contributor to their career development.

Conclusion

While we may lament that theory and practice do not match, remember that it has been a very, very good couple of years for our profession. We've enjoyed an optimistic employment picture, even with the downturn in the computer industry. And budgets are continuing to rise, albeit slowly. These days, everyone, even John Naisbett, Ronald Reagan, and my mom, is interested in technology and training.

So what can we learn from the discrepancy between what we are talking about in the academy and what happens in the field?

1. That our models, research and theories are not having the impact on the field that we desire.

2. That academics must spend some time speculating *why*. Is it for lack of effort on our parts? A mismatch between our literature and the reading habits of practitioners? The inability of our graduates to make clear cases for systematic and theory-based approaches? An absence of lean and sturdy prescriptions for practice based on this research and theory?

3. That practitioners, too, must self-evaluate. Is the current state of practice sufficient? Do they take time to evaluate themselves and the assumptions under which they operate? Are practitioners availing themselves of new ideas, theories and technologies? Are their skills current? Are they allowing the bottom line to rule them without pressing back on behalf of more optimal instructional designs?

For the past decade, academics have turned to the field for illumination on what we should teach our graduate students. How many studies have there been which ask employers to please tell us what they want our graduates to be able to do? Dozens, maybe hundreds. While that is certainly one crucial source of information, it is not the only source.

The field is ruled by concern with getting the job done; the academy must focus on how it might be done better. There is obvious interdependence.

What I've experienced and what TRAINING found reminds me of a responsibility that graduate educators may overlook in our haste to be relevant to the needs of the field: **We must do more than respond to the field. We must define it through the compelling nature of the research and development that we do and model it through the superlative quality of our graduates.**

Nodding in agreement isn't good enough. I am asking every professor and student to think how he or she might contribute to the improved practice of instructional design. First think about it. And then, go out and do it.

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Microcomputers and Continuing Motivation

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Running head: MICROCOMPUTERS AND CONTINUING MOTIVATION

Abstract

This study investigated the effects of medium of instruction, task difficulty, and gender on continuing motivation. A total of 139 fifth and sixth graders with previous computer experience completed an initial learning task in one of the two media formats (computer or paper/pencil) and under either a hard or easy difficulty level. Subjects' choice of instructional medium for a second learning task was the measure of continuing motivation. Sixty-seven of the 69 computer subjects (97 percent) chose to return to the computer, whereas only one of 70 paper/pencil subjects (one percent) chose to return to the paper/pencil form, $p<.0001$. The remaining 69 chose the computer for the second task. Questionnaire data indicated that computer subjects also evaluated their own performance significantly more highly, reported the task to be significantly more interesting and easier, and had a greater desire to study more of the same type of subject matter.

MICROCOMPUTERS AND CONTINUING MOTIVATION

Microcomputers are rapidly becoming an important medium of instruction. Research on computer-assisted instruction (CAI) has often focused on student learning through comparisons of several teaching methods (Clark, 1983; Jamison, Suppes, & Wells. 1974). Some evidence exists that CAI may be more effective than traditional teaching methods (Bell, 1983; Kulik, 1983; White, 1983). However, Clark (1983) suggests that the causal comparisons between CAI and achievement are confounded by the uncontrolled effects of novelty and instructional method. Indeed, until recently relatively little attention had been given to how strong student motivation is to use computers and to continue to use them under various conditions. Like student achievement, willingness to return to computer-based learning tasks is also an important consideration related to the effects of computers.

The role of motivation in CAI is becoming a more prominent topic in the professional literature. Swenson and Anderson (1982) state that the motivational reinforcement of CAI is perhaps its strongest asset. The format of CAI has been looked at for clues on motivating characteristics which aid learning (Dence, 1980; Malone, 1980). Roblyer (1985) noted that the motivation behind the improvement of attitudes toward subject matter in the CAI format is often attributed to the computer itself.

Research is far from definitive on the extent to which microcomputers motivate students and the conditions that maximize the motivation. The effectiveness of CAI has been attributed in part to a novelty factor (Grimm, 1978; Kulik, Bangert, & Williams, 1983). However, neither Kulik, Kulik, & Cohen (1980) nor White (1983) found evidence for a novelty effect in their reviews of computer use. Computer experience has been found to be a major factor in computer attitudes (Enochs, 1984; Loyd and Gressard, 1984). The motivational effects of CAI have also been examined from a number of other standpoints, including retention, feedback, learner control, and individualization (Dence, 1980; Roblyer, 1985).

A considerable body of recent research has centered on continuing motivation (McCombs, 1984), which generally has been defined as the free choice to return to a previous learning task instead of an alternative task. The difficulty level of the original task and the gender of the learners are two factors that have been found to be associated with continuing motivation.

Task difficulty is well established as a factor that influences motivation (Lepper, 1985; Story & Sullivan, 1985). Return to task, as the measure of continuing motivation, has been found to be significantly higher when subjects initially perform an easy task rather than a hard one (Harter, 1975b; Hughes, Sullivan, & Mosley, 1985; Pittman, Emery, & Boggiano, 1982). Task difficulty has also been found to interact with subject gender. Boys tend to return more frequently to challenging tasks and girls to easier ones (Harter, 1975a,b; Wigfield, 1984). Whether these findings on continuing motivation as it relates to task difficulty and gender extend to computer-assisted learning tasks has not been investigated experimentally.

A recent study by Mosley, Haas, & Story (1984) suggests that the use of the computer itself may be a strong factor in promoting continuing motivation. These researchers studied the motivation of sixth grade students for tasks of differing difficulty levels as presented exclusively by microcomputer. The overall return-to-task rate on the computer-based task was far higher than return rates in two previous continuing motivation studies (Hughes, Sullivan, & Mosley, 1985; Mosley, 1983) using learning tasks presented only in paper/pencil format.

The present study was conducted to investigate experimentally the relationship to continuing motivation of instructional medium, task difficulty, and sex of subject. Two types of media, computer and paper/pencil, were crossed with two levels of difficulty, hard and easy. The measure of continuing motivation was student choice of instructional medium for a second learning task after they had completed an initial task either on a microcomputer or in paper/pencil form. Student attitudes related to the two media were also assessed.

Method

Subjects

The subjects were 139 fifth and sixth grade students from six classes in a suburban school located in a middle-class socioeconomic area. All were familiar with computers and the school computer lab where the research was conducted.

Materials

The experimental materials were two sections from the Grade 5-6 "Power Switch" unit from the (Energy Source Program, 1984). For this study, two separate sets of eight questions each, one set to be answered at the end of each of two sections, were adapted from questions in the original unit. The questions were prepared in paper/pencil form for the paper/pencil group and were put on floppy disks for the computer group. The format of the questions was the same on the computer screen as on paper. Feedback was included after every item on the computer, as is normal in CAI, and after each set of 8 items for the paper/ pencil group.

The easy/hard variation in task difficulty was achieved by manipulating the difficulty level of the questions. The questions in the easy version were three-choice multiple choice items. Those in the hard version were completion items which required subjects to recall the correct answer and write it in. The multiple-choice and completion items covered identical content. A preliminary tryout with one Grade 5 class and one Grade 6 class indicated that the two versions did indeed vary in difficulty level. Students averaged 43% on the hard version and 74% on the easy version.

Procedures

Boys and girls were randomly assigned to one of the treatment groups, computer or paper/pencil, and to either the hard or easy difficulty levels. Except for their assigned medium, the procedures were the same for the computer and paper/pencil groups.

In both treatments, the text was read aloud by students who were previously identified by the teacher as good readers. The other students followed along. At the end of the first section, subjects answered the first set of questions on their own in their assigned paper/pencil or computer medium. Subjects then read the second section and answered the questions over it in the same manner. After finishing these questions, all subjects completed a six-item questionnaire on which they marked their choice of medium (computer or paper/pencil) for a possible second learning task and indicated their perceptions of the initial task.

Data Sources

The proportion of subjects who chose to return to the same medium for the second task served as the measure of continuing motivation. Other data on student attitudes were obtained from the follow-up questionnaire items dealing with perceived performance, student interest, task difficulty, and desire for further study about energy.

Design and Data Analysis

The experimental design was 2 (medium) x 2 (difficulty) x 2 (gender) completely crossed factorial design. Data were analyzed by analysis of variance for return to task and by chi-square for the questionnaire items.

Results

Return to Task

The frequency of subjects returning to task by treatment and gender is shown in Table 1. The 2 x 2 x 2 ANOVA yielded a highly significant effect for medium, F(1,137) = 1488.32, $p<.0001$. Sixty-seven of 69 subjects (97 percent) in the computer treatment chose to return to the computer for a second learning task. In contrast, only one of the 70 (one percent) in the paper/pencil version chose paper/pencil for the later task. The other 69 paper/pencil subjects preferred the computer for the second task.

Insert Table 1 about here

The effect for instructional medium was so powerful that it left little room for possible effects for task difficulty and gender. Nearly all subjects at both difficulty levels and of both sexes chose the computer as the medium for a future task. Of the three who did not, one male and one female were initially in the hard difficulty level for the computer group and one female was in the hard level of the paper/pencil group.

Student Attitudes

Attitudes of students in each group, as indicated by their responses on the follow-up questionnaire, are shown in Table 2. As shown in the table, significant

Insert Table 2 about here

differences favoring the computer group over paper/pencil subjects were found on all five items. Summing of the first two columns for items 1-3 reveals that more students in the computer group thought that they did well on the activity (85 percent to 69 for paper/pencil), that the activity was interesting (96 percent to 81), and that the activity was easy (80 percent to 47). More computer than paper/pencil subjects also reported that they would rather study energy again than another subject (29 percent to 14) and that they would rather do another energy lesson than not do another lesson at all (87 percent to 64 percent).

En Route Performance

Mean scores for performance on the 16 en route practice items were also calculated for the two treatment groups. The overall means were very similar for the two groups--7.72 items correct for paper/pencil and 7.64 correct for computer subjects.

Total time on task was approximately 45 minutes for both the computer and paper/pencil subjects and did not differ significantly between the two groups.

Discussion

The present study was conducted to investigate the effects of medium of instructional practice and task difficulty on the continuing motivation of boys and girls. Results indicated an extremely strong preference for further instructional practice on the microcomputer over a paper/pencil format. This effect was so strong that it left room for only slight variations related to task difficulty and subject gender. Questionnaire responses of subjects also revealed much more favorable attitudes toward the computer than paper/pencil.

The most profound finding was the strong motivational effect of the computer as indicated by the fact that 67 of 69 students (97 percent) in the computer group and 69 of 70 (99 percent) in the paper/pencil group chose the computer for their second learning task. Though microcomputers have been cited as having high motivational value (Lepper, 1985; White, 1983), the overwhelming preference demonstrated by subjects in this study was certainly unexpected. Preference for the computer was nearly unanimous whether students did the initial task on the computer or in paper/pencil format. This powerful preference occurred even though students in the computer group did not perform any better on the en route practice items for the learning task than did those in the paper/pencil group.

Another strong finding was the important positive effect the computer had on student attitudes. The more positive attitudes revealed by the questionnaire responses complement the return-to-task data. Certainly interest is an important component of motivation (Hawkins, 1984; Maehr, 1976; Malone, 1980). Subjects in the computer group rated the learning as more interesting than those in the paper/pencil treatment, even though the substance of the activity was the same for both groups. Similarly, more subjects in the computer group thought that they did well on the activity and that it was easy. Yet, these impressions were not substantiated by the performance data for the task--the two groups performed almost equally well on the practice items, with a very slight, nonsignificant difference favoring paper/pencil subjects. That is, since the computer group did not in fact outperform the paper/pencil group, merely doing the task on the computer apparently resulted in their thinking that they did well and that it was easier.

The positive attitudes associated with the computer as a medium of instruction also generalized to the subject matter itself. A significantly greater number of subjects in the computer group than in the paper/pencil group reported a preference for studying energy again over studying some other subject matter and over not doing another activity at all. That use of the computer to study particular subject matter could increase students' interest in that subject-matter area is potentially an important finding. It would be especially valuable if students could maintain the increased subject-matter interest on a long-term basis and if they were motivated toward more independent study of the subject-matter area.

The strength of the motivational and attitudinal effects associated with the computer were surprising in that it was intentionally used only as a substitute for the paper/pencil medium. To keep other conditions highly similar across the two presentation media, no other capabilities such as special graphics or personalized or interactive feedback were incorporated into the computer treatment. The results produced by the computer under these constraints suggest that instructional applications that capitalize on its special capabilities (Sawyer, 1985) may further complement its motivational potential.

Although this study was designed to deal with student motivation, it also yielded data on en route performance on the learning task. In contrast with the motivational and attitudinal data, the performance scores of the computer and paper/pencil groups were virtually identical.

Thus, there was no evidence that the more positive attitudes of the computer group or their item-by-item feedback had an effect on their achievement on the learning task. This finding is consistent with Clark's (1983) contention that different presentation media *per se* do not directly affect student learning when the other elements of the instruction are the same across the two or more media.

The medium of instruction was so much more powerful a variable than either subject gender or task difficulty that no meaningful conclusions can be drawn from this study about the relationship of the latter two variables to continuing motivation. The overwhelming preference for the computer washed out any differences that might have occurred for gender or task difficulty under other conditions. This preference was nearly unanimous among both females and males and across both the hard and easy difficulty levels.

The present findings clearly reveal that microcomputers potentially have strong positive motivational and attitudinal effects in the classroom. Still, considerable caution should be exercised in generalizing too freely from these results to long-term classroom practice because this study measured only immediate effects from a one-session experiment. The novelty effect often associated with computers might have been a factor in the present results, but any such effect may have been reduced by the fact that the subjects were experienced with computers. Overall, the positive results favoring the computer group were so strong and consistent that it seems highly probable that they were due primarily to the appeal of the computer itself and only secondarily, if at all, to other factors.

A worthwhile area for further research is the study of effects of microcomputers when they are used as the primary medium of instruction with a program over an extended time period. Would students continue to show the strong preference for the computer that they demonstrated in this study, or would it lose much of its appeal over time? Student interest in the subject matter itself and student achievement would also be important factors to investigate in such longer-range studies. Research on the effects of microcomputers over an extended period should help us better understand their most productive uses in promoting student motivation and achievement in the classroom.

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Table 1

Frequency of Return by Medium of Instruction, Gender, and Task Difficulty[1]

	Computer Practice			Paper/Pencil Practice		
	Female	Male	Total	Female	Male	Total
Hard	17/18 (94%)	18/19 (95%)	35/37 (95%)	1/19 (5%)	0/15 (0%)	1/34 (3%)
Easy	18/18 (100%)	14/14 (100%)	32/32 (100%)	0/15 (0%)	0/21 (0%)	0/36 (0%)
Total	35/36 (97%)	32/33 (97%)	67/69 (97%)	1/34 (3%)	0/36 (0%)	1/70 (1%)

[1] The cell entries represent the number of students out of the total cell number who chose to return to the same medium for the second task. For example, 17 of the 18 female students (94%) on the computer version of the hard task chose the computer for the second task. In contrast, only one of 19 female students (5%) in the paper/pencil version chose to return to it. The other 18 chose the computer version for the second task.

Table 2

Questionnaire Responses by Treatment

Questionnaire Items and Responses χ^2 & p level

What do you think?

1. On this activity, I think I did:

	very well	well	badly	very badly	
Computer	36%	49%	12%	3%	$\chi^2(3) = 10.751$ $p < .02$
Paper/Pencil	17%	52%	17%	14%	

2. I thought this activity was:

	very interesting	interesting	boring	very boring	
Computer	57%	39%	3%	1%	$\chi^2(3) = 10.417$ $p < .02$
Paper/Pencil	34%	47%	13%	6%	

3. I thought this activity was:

	very easy	easy	hard	very hard	
Computer	19%	61%	17%	3%	$\chi^2(3) = 17.888$ $p < .0005$
Paper/Pencil	17%	30%	40%	13%	

If we return to do more activities with you, what would you prefer?

4. (a) study energy again:	(b) study some other subject:	
Computer = 29%	Computer = 71%	$\chi^2(1) = 4.259$
Paper/Pencil = 14%	Paper/Pencil = 86%	$p < .05$

5. (a) do another energy lesson:	(b) not do another lesson at all:	
Computer = 87%	Computer = 13%	$\chi^2(1) = 9.991$
Paper/Pencil = 64%	Paper/Pencil = 36%	$p < .002$

THE EFFECTS OF ORGANIZATIONAL CUES ON LEARNERS' PROCESSING OF INSTRUCTIONAL PROSE

Researchers and developers have given considerable attention recently to the design and development of instructional text (Jonassen, 1983, 1985; Waller & Duffy, 1985). Guidelines arising from this emphasis recommend techniques with which authors of instructional messages, whether they be mediated in printed text, CRT display, or other electronic media, may employ in order to design effective, unambiguous text. A very common recommendation is that designers of instructional text make the structure or organization of an instructional passage as explicit as possible through the use of outlines, headings, summaries, titles, marginal notes, and transitions that cue top-level structure (e.g., Hartley & Burnhill, 1980; Irwin & Davis, 1980). Provision of such cues in text is hypothesized to promote top-down processing, i.e., the formation or activation of relevant schemata in order to ease the decoding burden of reading.

Although the use of such cuing techniques has proved to enhance retention and comprehension in many cases, this effect has not been unilateral (Brooks, 1981; Christensen & Stordahl, 1955; Hartley, Kenely, Owen, & Trueman, 1980; Klare, Shuford, & Nichols, 1958). These equivocal effects may be the result of learners' differential susceptibility to organizational cues in text. Some learners may simply be unaware of the role of these cues in the instructional message and/or how to utilize these

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cues in order to enhance comprehension and aid recall. If this is the case, instructional designers may faithfully incorporate explicit organizational cues in their materials, and still find that substantial portions of their target audience do not benefit from such textual aids. The studies reported in this presentation investigated the differential effects of organizational cuing and strategy training on a group which has been suggested as particularly insensitive to the effects of organizational cues: learning disabled adolescents (Stanovich, 1983; Woodward & Peters, 1983).

One explanation offered for LD students' learning problems is that they possess the innate capacity to succeed on such tasks, but lack knowledge about and/or the ability to use strategies which promote efficient learning. Torgesen (1977, 1979) investigated this hypothesis in his seminal study of LD students' ability to memorize. He found that LD students performed as well as their nonLD counterparts in a memorization task when first taught a strategy for learning stimulus word lists. Torgesen (1980) argued convincingly that LD student had the ability to learn, they simply did not know how to approach the learning task.

The concept of strategy training has been widely recommended as a means of designing effective instruction for secondary LD students (Alley & Deshler, 1979); Smith, 1983; Woodward & Peters, 1983). Alley, Deshler, and their colleagues have made significant contributions in strategy deficit remediation: They have outlined a series of steps for teaching learning strategies to LD adolescents (Deshler, Alley, Warner, & Schumaker, 1981) and

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have completed numerous studies demonstrating the efficacy of this approach. A modification of this approach was employed in Study 2.

This presentation will describe the findings of two studies that investigated the following questions related to this specific audience's response to organizational cues in texts:

Study 1

-- Does organizational structure have differential effects on LD and nonhandicapped learners? Do these effects vary according to the type of organizational structure?

Study 2

-- Can a reading strategy employing recognition and utilization of organizational structure be taught to LD students? How does this training influence their recall and retention of instructional prose?

Study 1

Participants and Methodology

The participants for this study were 37 LD and 50 nonhandicapped students from a suburban high school (grades 10 through 12) in central Oklahoma. Students from each group were randomly assigned to treatment conditions such that half of each group read a passage with a comparison-contrast top-level structure and half read a passage with a description top-level structure.

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The instructional passages (7-8th grade reading grade level, Dale-Chall readability formula) used in this study were content area reading passages from high school social studies texts. Passages with two different top-level structures were used in order to ascertain if LD and nonhandicapped students were differentially sensitive to a very cohesive structure (comparison/contrast structure) and a less cohesive structure (description structure).

Data were collected in three sessions. First, students were supervised by their teachers while answering the ten pretest comprehension questions designed to determine prior knowledge of content. One week later, they read their assigned passage, completed the immediate recall task, and then responded to the set of 15 posttest comprehension questions. One week after the above procedure, the teachers administered the delayed recall task.

Comprehension items were scored as right or wrong. Recall protocols were scored in two ways. First, they were scored for idea units recalled using a procedure suggested by Meyer's (1975) discourse analysis technique. Interrater reliability of the scoring was found to be .97. Participants' sensitivity to organizational structure and author's cuing of such structure was assessed by their use of the author's organizational structure when producing their written recall protocols. A rating scale adapted from Swanson (1980) was used to assess use of text structure in recall. An interrater reliability of .83 was obtained using this instrument.

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Results

Two 2 (passage: comparison/contrast, description) X 2 (group: LD and nonLD) analyses of covariance with prior knowledge as a covariate revealed the LD students were indeed less sensitive to the author's top-level structure, regardless of the passage type, both at the immediate stage ($F_{1,81} = 4.19$, $p < .044$) and at the delayed recall stage ($F_{1,81} = 5.85$, $p < .018$). This lack of sensitively to structure influenced participants' level of recall. Two one-way ANCOVAs examined three levels of text structure use (high, medium, and low) on immediate and delayed recall. Text structure use had a significant effect on immediate recall ($F_{,} = 6.84$, $p < .002$) and delayed recall ($F_{,} = 11.51$, $p < .0001$). Tables 1 - 6 show the means of these treatment groups by the types of learners.

Insert Tables 1 - 6 about here.

Study 2

Participants and Methodology

Participants were 73 learning disabled adolescents (grades 10 through 12) in two high schools in Oklahoma. The schools were randomly assigned to one of the two treatment groups. An examination of reading test scores from the two groups indicated that groups were equitable in general reading ability. One group received instruction in a reading strategy emphasizing the recognition and use of authors' organizational structure while encoding and retrieving instructional prose. The second group received a placebo instruction on generic problem solving (not related to prose processing), **The Productive Thinking Program** (Covington, M.V., Crutchfield, R.F., Davies, L., & Olton, R.M., 1974).

During the week prior to instruction, each group was pretested in order to assess their recognition of common organizational structures, their recall of instructional prose, and their ability to organize their recalls using the author's organizational structure. The following week, each group received approximately four hours of instruction. The experimental group completed print- and teacher-mediated instruction, including instruction on recognizing five organizational structures commonly used in content texts (time-order, problem-solution, cause-effect, comparison-contrast, description) and using these structures as aids during encoding and retrieval. This instruction was typified by extensive practice with examples and nonexamples, teacher and peer modeling of strategies, and analogical illustrations to describe mental processes. The instructional strategy for this training followed these phases:

a) students were asked to read and recall a lengthy passage with an explicitly cued text structure;

b) they were asked to describe the manner in which they went about reading and remembering the material and the inefficiency/inadequacy of this approach was discussed;

c) a new strategy using text structure as an encoding and

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retrieval cue was presented as a more efficient/effective approach to this type of reading;

d) students were taught to recognize five typical expository structures;

e) they practiced this identification with increasingly complex prose;

f) the text processing strategy was presented, modeled by the instructor in a think-aloud manner, and then practiced in peer dyads with increasingly complex material; and

g) students practiced identifying instances when the strategy could be appropriately applied.

The control group completed workbook exercises on general problem solving strategies such as locating and describing the problem, considering alternative solutions, etc. At the conclusion of the week, students completed a posttest that assessed their recognition of common organizational structures, their use of structure in organizing recall of an instructional passage, and their recall of the passage content. One week after the final instructional session, all students responded to a delayed posttest which was an alternate form of the posttest.

Results

Four separate 2 (reading level: low, reading level = 4.0 - 7.0; high, reading level = 7.1 - 10.0) X 2 (treatment: experimental, control) analyses of variance were conducted in order to examine the main effects and interactions of the treatments and reading levels on four dependent variables (immediate recognition of structure type, immediate recall

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performance, delayed recognition of structure type, and delayed recall performance). An alpha level of .05 was set prior to conducting the analyses.

The ANOVAs revealed several main effects, including main effects for treatment on immediate recognition of structure type ($F_{1,50}$ = 141.954, p < .001), on immediate recall performance ($F_{1,80}$ = 26.039, p < .001), on delayed recognition of structure type ($F_{1,50}$ = 99.562, p < .001), and on delayed recall performance ($F_{1,50}$ = 20. 787, p < .001). No interactions were found between treatments and reading groups. Tables 7 - 8 show the means in the analyses.

Insert Tables 7 - 8 about here

Learners' written recall protocols showed evidence that students in the experimental group used the text structure strategies they had been taught: several drew pictures of the structures, other underlined key words, and many organized their recalls according the text top-level structure.

Conclusions

The results of Study 1 indicate that, as anticipated, LD students are not as sensitive as their nonhandicapped counterparts to the organization of instructional prose. This insensitivity appears even when prior knowledge is statistically partialed out. In addition, results suggest that this lack of sensitivity contributes to LD students' poorer recall and retention of instructional prose.

The results of Study 2 indicate that training in a text structure use strategy did significantly improve both students' recognition of these structures and their recall of instructional content, and this effect remained relatively stable over at least a week. In other words, the results strongly suggest that students who typically experience severe difficulty in reading comprehension can be taught to use a text structure strategy, and this instruction can improve their recall of information within social studies passages. An examination of the students' recall protocols indicated that students in the experimental group actually used the strategy during the reading and recall tasks. In addition, in the weeks following the study, the LD students' teachers reported that the students continued to make reference to and use their newly acquired reading strategy. Evidently the strategy training had considerable impact upon students' encoding and retrieval behaviors.

The conclusions of these studies have several implications for designers and developers of instructional print materials. First, they provide evaluative data on a particular instructional strategy for teaching toward cognitive strategy outcomes. Second, they point out that including explicit cues to organizational structure in instructional prose may benefit only a portion of the target audience, excluding those portions of the audience that are poor readers. Third, they suggest some additional instruction ("self-conscious text," Pace, 1985) that

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may be included alongside content instruction that will aid learners who have immature text processing strategies.

Future investigations are planned to examine other implications of text structure cuing and strategy use. First, strategy training will be extended to include instruction using longer passages that are typical of the passages that LD students must contend with in content area classes. Second, content area instruction will be designed to teach this text processing strategy alongside targeted content objectives. The efficiency, effectiveness, and transferabiity of this learning will be examined.

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Table 1

Mean scores on Comprehension Posttest

Passage	Group LD	 NonLD
Adversative	8.000	11.269
	(3.406)	(1.710)
	n=21	*n*=26
Attributive	7.125	10.958
	(2.604)	(1.899)
	n=16	*n*=24

Note: Maximum score = 15.

Table 2

Mean Number of Idea Units Recalled--Immediate Recall

Passage	Group	
	LD	NonLD
Adversative	21.063	40.615
	(10.871)	(14.577)
	n=21	*n*=26
Attributive	24.095	41.375
	(11.749)	(18.939)
	n=16	*n*=24

Note: Total number of idea units = 159.

Table 3

Mean Number of Idea Units Recalled--Delayed Recall

Passage	Group LD	 NonLD
Adversative	14.500	30.654
	(11.599)	(12.652)
	n=21	n=26
Attributive	17.571	31.042
	(12.385)	(15.708)
	n=16	n=24

Note: Total number of idea units = 159.

Table 4

Mean Ratings of Structure Use--Immediate Recall

	Group	
Passage	LD	NonLD
Adversative	5.300 (2.939) n=21	6.654 (2.497) n=26
Attributive	5.437 (3.098) n=16	6.833 (2.823) n=24

Note: Ratings ranged from 1 (low) to 10 (high).

Table 3

Mean Ratings of Structure Use--Delayed Recall

Passage	Group	
	LD	NonLD
Adversative	4.500	6.654
	(2.893)	(2.497)
	n=21	n=26
Attributive	3.938	4.708
	(3.098)	(2.662)
	n=16	n=24

Note: Ratings ranged from 1 (low) to 10 (high).

Table 6

Mean Number of Idea Units Recalled by LD Students as a Function of Structure Use and Passage Type

Passage	Structure Use Rating Low[a]	Medium[b]	High[c]
Attributive			
Immediate	16.60	17.37	33.25
	(6.39)	(7.78)	(11.44)
	n=5	n=8	n=4
Delayed	12.22	7.00	30.00
	(8.50)	(3.16)	(10.17)
	n=9	n=4	n=4
Adversative			
Immediate	22.71	23.29	27.67
	(16.02)	(6.73)	(11.98)
	n=7	n=7	n=6
Delayed	12.50	19.80	23.80
	(13.01)	(8.70)	(12.40)
	n=10	n=5	n=5

Note: Total number of idea units = 159.
[a]Low ratings ranged from 1 to 3. [b]Medium ratings ranged from 4 to 7. [c]High ratings ranged from 8 to 10.

Table 7

Mean Structure Recognition Scores on Posttest and Delayed Posttest

	Treatment	
Reading Level	Experimental	Control
Low (4.0 - 7.0)		
Posttest		
M	2.29	.11
SD	.69	.33
n	17	9
Delayed Posttest		
M	2.18	.22
SD	.88	.44
n	17	9
High (7.1 - 10.0)		
Posttest		
M	1.85	0
SD	.90	0
n	13	15
Delayed Posttest		
M	2.77	.33
SD	1.09	.49
n	13	15

Note: Maximum score possible = 3

Table 8

Main Idea Units Recalled on Posttest and Delayed Posttest

	Treatment	
	Experimental	**Control**
Reading Level		
Low (4.0 - 7.0)		
Posttest		
M	11.59	5.78
SD	6.09	3.63
n	17	9
Delayed Posttest		
M	12.23	5.22
SD	6.76	3.77
n	17	9
High (7.1 - 10.0)		
Posttest		
M	16.0	6.87
SD	5.99	4.63
n	13	15
Delayed Posttest		
M	12.85	6.27
SD	6.04	2.76
n	13	15

Note: Maximum score possible posttest = 150. Maximum score possible delayed posttest = 128.

INSTRUCTIONAL SIMULATION:
RESEARCH, THEORY, AND A CASE STUDY

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INTRODUCTION

Simulations have been used to deliver instruction in educational, military, and industrial settings for many years. Although the technique has repeatedly been demonstrated to be effective, its use has been somewhat limited in higher education because of the relatively high costs connected with the development and presentation of the materials. With the advent of computer interactive video, simulation has become more affordable for everyone. Thus, simulation holds great promise for future application in many instructional settings. This presentation will focus upon theory, research, and practice related to instructional simulations.

Let us begin with a definition of the term simulation. A good starting point is to look at the way the term is described by the major indexes of the literature of Education. Two indexes, the Current Index to Journals in Education and Resources in Education include the following explanation to clarify the meaning of the descriptor "simulation." "Duplication of the essential characteristics of a task or situation." An examination of the literature itself reveals that most writers agree with the indexes, emphasizing the idea that simulation indeed "duplicates the essential characteristics" of reality. According to various writers, our simulated reality may be abstracted and/or simplified (Heinich, Molenda, & Russell, 1985), lifelike (Cruickshank, 1966), and/or controlled (Fink, 1973).

Simulations do more than merely present manipulated "realities," however. In addition, they call upon the learner to respond through decision-making (Rice, 1966), problem solving (Cruickshank, 1966), and/or role playing (Pollack, 1973). Further, participants in simulations must deal with the consequences of their responses (Spannaus, 1978).

While most writers appear to define simulation in slightly different terms, common elements are also evident. Based upon definitions from the literature, the following eclectic version is offered: simulations are controlled representations of real situations, calling for participants to respond, and providing some form of feedback to those responses. Instructional simulations are those simulations intended to result in predetermined learning outcomes.

It is useful, at this point, to make a distinction between simulations as defined above, and games. Games have, as an identifying characteristic, the element of competition (Coombs, 1978; Locatis & Atkinson, 1984). Simulation games are those simulations which have the element of competition built in to the materials and processes. It will not be the intent of this paper to deal directly with simulation-games, although useful and appropriate applications to games may be derived.

This work will deal with instructional simulations as used in higher education, and will focus upon applications in the area of preservice and inservice teacher education. First, a brief historical review will be presented, featuring the pioneering work of Bert Kersh and associates at the Teaching Research Division of the Oregon State System of Higher Education. Then, a summary of research will be presented, followed by a short descriptive analysis of how simulation relates to representative elements of three learning theories. A rationale for using simulations will be offered and illustrated with a case study. Finally, some directions for future research and development will be proposed.

HISTORICAL OVERVIEW

Simulations have been successfully used for many applications in military training. Richard Braby of the Naval Training Device Center in Orlando, Florida (Twelker, d970), argues convincingly for using simulations:

> I don't think we could ever talk a pilot into having the behavior that he must perform in the aircraft. You could talk to him for 30 years and he would never be able to perform under the stress of actual flight. In other words, in the classroom you don't have the stimuli that will actually trigger the behavior...I think you have to experience it." (p. 1)

Other applications from the military have included relatively simple simulations such as "pocket blinkers which simulate the action of a ship's blinker light and enables trainees to practice Morse Code, . . . to exceedingly complex weapons systems which require teams of operators and analogue or digital computers." (Twelker, 1970, p. 2)

Likewise in industry, simulations have been used to deliver instruction. A good example is the flight simulator used by the Boeing Company to train pilots. These simulators employ sophisticated computer and video systems to present realistic flight situations to trainees. Procedures ranging from normal flight, to emergency situations, can be simulated to provide pilot-trainees with very realistic, controlled practice environments.

In the early 1960's, Bert Kersh and associates at the Oregon State System of Higher Education's Teaching Research Division, developed and conducted research using a sort of educational "link trainer." In this case, the simulation was designed to help preservice teachers develop competencies in classroom management techniques. Later, the simulation techniques were extended to "discovery teaching" as well.

The Teaching Research program included the systematic study of three simulation packages over a period of more than eight years. Their first simulation effort was intended as a research vehicle, through which sufficient information could be obtained to develop further materials. This first simulation program, "Mr. Land's Sixth Grade," consisted of a comprehensive package including: (1) an orientation to the school and community, (2) individual records on each student, and (3) sixty problem situations presented life sized, on 16mm color sound films. Students engaged in simulation training were placed in a room which was arranged to look exactly like an elementary classroom, complete to the teacher's desk and the American Flag. However, instead of facing a class of actual children, the "teacher" faced a large rear screen upon which a sixth grade classroom full of children, and problems, was projected. Whenever the "teacher" wanted to make a response, the film display was put on still frame, and the response was enacted in exactly the same manner as if in an actual classroom. On the basis of the "teacher's" response, a trainer/operator displayed another film showing the class' behavior either improving, or getting worse.

The Kersh group conducted many experiments on the original classroom simulator, providing important basic information for subsequent researchers. Results will be reported later in this paper. Toward the end of the 60's, additional simulations were developed and field tested. It was hoped that these "Low Cost" materials, dealing with classroom management and discovery learning techniques, would be widely disseminated. Instead of employing 16mm films, these simulations used a slide and audio tape format, with accompanying background materials. They were not developed or distributed beyond the field testing stage.

During the 60's others were also experimenting with the use of simulation in teacher education programs. Vlcek (1966), and Girod (1969), experimented with Kersh's classroom simulation materials in varied settings. Wynn (1964) examined simulations for teacher education using an "inbasket" technique. College students role playing elementary school pupils were the basis of simulations developed and studied by Dettre (1967) and Hershey, Krumboltz, & Shepard (1965). Here, college students played the part of elementary pupils to give practice in "simulated" teaching. Like Kersh, Broadbent (1967), Cruickshank (1966), and Utsey, Wallen, & Belden (1966), used 16mm films to present simulated classroom situations. Broadbent's "Brockport Simulation" presented 32 teaching problems set in a fictitious community. Ten of the problems were presented via film, the remaining ones were written materials. The stimulus situations were intended to stimulate group discussions of possible responses. These materials were also used by Cruickshank (1966). Utsey, et al., (1966) used films of children reading to give students practice in assessing reading ability.

Peer teaching, or the use of college students to simulate elementary school classes, continued to be used and studied during the 70's. Emmer (1970) focused on elementary education situations; Lehman (1970) on the teaching of secondary school biology. Simulated situations presented through written problem descriptions were developed by Zuckerman (1979). Situations ranging from administrative tasks, to planning activities, to classroom management, were included. Participants received feedback from simulation leaders regarding the adequacy of their responses. Drawing from the work of his colleagues in the United States, Tansey (1970) developed successful simulation materials for a teacher education program at Berkshire College of Education in England.

Computer based simulations began to appear during this period. Day & Parnes (1975) developed programs which provided teacher trainees with practice in making "pupil behavioral interventions." Students interacted with a computer which simulated the behavior of five handicapped students.

Another computer based simulation was marketed through the CONDUIT system. This program, called "School Transactions," was described as follows: "This series of simulations places a prospective teacher in a realistic school setting and asks him to solve problems involving students, other teachers, parents, and administrators. Each package includes three to five different simulations. Using these simulations, teachers can explore the effect of a variety of teaching styles and strategies." (p. 18) The materials were designed to run on Apple Computers, and are currently available.

So far, the 80's have brought interesting new developments in simulations for teacher education. For example, an entire graduate course in early childhood education was taught via an elaborate simulation (Harper, 1980). The National Center for Research in Vocational Education, Ohio State University (1982), has developed various simulations for use in training vocational education teachers. Included in the materials are role playing exercises, in-basket, case study, and gaming materials. Computers continue to be used for delivering simulations. Strang & Loper (1983) describe a microcomputer based simulation program in which the teacher trainee, hereafter referred to as "T," conducts a lesson with four students whose names are displayed on a monitor. T questions, discusses, etc., with students whose graphically designed hands pop up. The computer based simulation is controlled by an operator who is a physically isolated from T. Each teacher-student interaction is coded into the computer by the operator. A terminal display directs the operator regarding how to respond to the teacher. The pace of the interaction is similar to reality, due to the fast program routine, and operator training. Following the lesson, the teacher is furnished with a hard copy printout of her/his "teaching profile," pertaining to relative amounts of information, positive affect, feedback, etc. Two, twenty minute sessions are included. Another microcomputer based simulation for teacher education has been developed by Schieman & Winn (1983). Here, an incident is presented via video which is stopped at a decision point. The user is then provided with alternative responses. After a response is selected and entered into a computer, a probable response is shown.

Over the past 25 years, a number of different types of simulations have been incorporated into teacher education programs. Both entire courses, and parts of courses have been presented via simulations. Techniques have ranged from in-baskets, to case studies, to role playing, to computer mediated simulations. Stimulus situations have been presented in written, filmed, live, and computer formats. Interest has remained high in spite of the rather great amount of time and expense connected with the development of the necessary materials. After review of simulation efforts during this period, one is left with the impression that the technique was continually used, but not on a large scale.

THEORY AND RESEARCH

Any instructional materials may best be developed if the design can systematically relate those materials to instructional theories. One advantage of simulation techniques resides in the extent and degree to which they can be related to major instructional and/or learning theories. For example, when Kersh first developed his classroom simulation materials in the early sixties, he based them upon a behavioristic, operant conditioning model. Later, he changed his orientation to an information processing framework as he further developed his simulations. This illustrates quite nicely, the extent to which simulation has potential connections with various theoretical explanations of learning. In this section of the paper, some of those connections will be illustrated by making them explicit. As a footnote, it should be added that space and time do not permit a fully extended explication of those connections. One or two major points of support will be identified for each position.

Briefly stated, operant conditioning theory explains learning in a stimulus, response, stimulus (reinforcement) paradigm. The relationship between the stimuli, responses, and subsequent reinforcing stimuli, represents the crucially important relationship: reinforcements should occur rapidly and on predetermined schedules to be most effective. Here, simulations offer some special and unique training advantages. In a simulator, reinforcements can occur under conditions controlled by an operator/trainer. They can be given either in "real time," or on schedules that maximize their instructional effect. For example, in the natural setting, a reinforcement may not occur immediately, but if the simulation designer believes that it should occur right away, this can be built into the simulation sequence. Further, because simulations can exercise students through repeated trials of any problem situation, continued and repeated reinforcements may be used to shape behavior. Correct responses may thus be rapidly and efficiently developed, thanks to the controlled nature of the simulation system.

Turning to information processing explanations of learning we now find an emphasis on the processes involved in the storage, retrieval, and subsequent use of information and learned skills in new settings. The informational value of "reinforcements" or feedback now becomes very important. In the case of the Kersh materials, the feedbacks provided by the simulator were originally regarded as simply "reinforcing stimuli." Kersh came to believe, however, that the informational value of feedback was very important, and developed the idea of "controlled feedback." Now, through prompts, cues, repeated trials, or debriefing, crucial information contained within the multiple feedback loops of the ongoing instructional situation could be made apparent to the viewer.

Cognitive approaches to the learning process emphasize the notion that learning stems from a basic reorganization of knowledge which occurs within the learner's cognitive structures. The resultant "insights" are characterized by the discovery of previously unknown relationships. Often, such insights can be facilitated when reality is distorted, when situations can be presented in compressed time, or through other techniques which make new relationships quite apparent. Simulations, with their capacity for time compression and other forms of reality manipulation, provide unique opportunities for new perceptions of reality. These can lead, upon reflection and thought, to the insightful discovery of new relationships and fundamental changes in the cognitive structure.

These illustrative examples of relationships between simulation and learning theory are indicators of the degree to which simulation can be designed to follow various theoretical constructs. Additional cases could be made for connections between simulation and other theories as well, for example modeling/imitation, social learning theories, neurological approaches, etc. Clearly, simulation offers a vehicle for instruction which can be studied and developed within the contexts of many theoretical frameworks.

We turn now to a review of the research conducted on the various forms of simulation employed in teacher education. This review will cover a twenty five year period between 1960, and 1985. The studies will be organized into three basic categories according to their major focus: (1) feasibility studies, asking the question: "can simulations be developed and operated for reasonable costs?", (2) presentation mode studies, asking the question: "in what form(s) so simulations work best, and (3) outcome studies, asking the question: "what kinds of measurable changes in student response result from the use of simulations?" The reader will recognize that, as in most category systems, some overlapping occurs. The studies cited will be confined to those conducted on simulations for teacher education. Exceptions will be made for reports summarizing large programs of simulation research, and a few, selected simulaton studies from other fields which, in my opinion, provide special information relevant to simulations in teacher education contexts.

Feasibility

As one reviews the studies, it quickly becomes apparent that relatively few have focused upon the feasibility question: "Is it possible to produce adequate and reliable simulations for an acceptable cost?" During the late sixties, Twelker and associates at Teaching Research in Oregon, set about to answer this question by developing and field testing two sets of simulation materials. Their objective was to produce "low cost" materials which could be used widely in teacher education programs. According to Twelker (1970)

> The original "classroom simulation" materials developed by Kersh (1963) provided students with an opportunity to react in a lifelike manner to film sequences, and to experience probable pupil consequences. Although quite effective, these pioneering efforts were limited, in terms of the expense of materials and equipment, and the time required to train even small numbers of students. These limitations led to the development of "low cost" instructional simulation materials for use in teacher education programs. (p. 11)

Two series of simulations were ultimately developed, the "Classroom Management Series," and the "Discovery Teaching Series." The classroom management series was field tested at ten sites scattered across the country. The Discovery series was not developed sufficiently to field test. Results, in the words of Twelker:

> ... revealed that the Classroom Management Series left little to be desired in way of timliness and credibility. Designwise, improvements were indicated that would be expected to have a significant, positive effect on strength, robustness, reliability and affect created by the system. Data revealed that the materials did not cause all students to reach expected proficiency, and affect was borderline in some cases. The system was found to be manageable. (p. ii)

While the system did not prove to be as effective as hoped or planned, improvements were indicated that were expected to have positive effects on the "strength, robustness, reliability, and affect" created by the system. Twelker indicated that such changes would "not be impossible to perform," and that they "should not be ignored." (p. 102) In spite of this, however, no further changes were ever made upon the materials, nor were they redeveloped or disseminated.

Thirteen years later, in 1983, Schieman and Winn developed and field tested three simulations: "Music," "Management," and "Counseling." Critical incidents were presented via an interactive videotape system. After viewing a stimulus situation presented by videotape, the student entered a response into a microcomputer, and a video sequence showing a probable response was presented. In the words of the authors, "...the results of the formative evaluation were very encouraging. All three simulations received high ratings on attitude, realism and technical quality." (p. 330) After the development of the materials had been completed, they were evaluated once more as complete packages by an external evaluator. Again, in the words of the authors "...we were pleased to conclude that all three simulations were convincing, well liked, and for the most part successful in achieving what they set out to do." (p. 331) Some limitations were noted with the relative slow speed of tape access, and a few participants indicated that they would have preferred more interaction with the materials. However, in general the findings of the field test were positive and encouraging.

Buehning and Schieman (1983) developed a classroom simulator for music teachers. As in the previous study, this simulation was presented through an interactive video tape format. Speaking to the feasibility question, they reported:

> An evaluation conducted by an outside examiner revealed its effectiveness and indicated that the strategy can and should be an integral part of teacher training programs. This project demonstrates that available technology can be used to structure and deliver instruction in human interaction. (p. 55)

Related to the question of feasibility is the matter of the time required for students to complete simulation training. Simulations have been criticized on the grounds that they take more training time than "conventional" instruction. Coleman (1973), in summarizing the Hopkins Game Research, revealed that indeed simulation training does take more time than instruction using an "information processing" (more conventional) approach.

If simulations can be designed to reduce training time, then their feasibility is enhanced. Two studies of classroom simulation have directly investigated this question. In the first study, Twelker (1965) found that prompts made simulations more efficient, in the second study

Girod (1969), comparing audio tapes with filmed versions of simulated materials, found that the training time was reduced using the audio tape version. These data suggest that simulations can be designed for reduced instructional time, thereby increasing their feasibility relative to other instructional modes.

In at least two cases involving simulations developed for teacher education settings, Broadbent's "Brockport" simulation (1967), and the Conduit simulations (1985), materials have been disseminated through commercial publishing houses. Although no experimental test of feasibility can be reported on these materials, one assumes that their continued availability through private, for profit concerns, demonstrates cost effectiveness.

In summary, we would note that while the early attempts toward "low cost" simulation by Twelker and associates was not successful, subsequent simulations have been successfully developed and disseminated. Simulations have a potential for efficient instruction, with the most recent versions, based on interactive video formats, showing particular promise for continued low cost development.

Presentation Modes

A number of studies have sought to compare various alternative methods of presenting simulations in teacher education. Girod (1969), compared film and audio tape versions of classroom simulation materials dealing with classroom management. He found that the audio tape version required fewer learning trials to criterion, but his subjects generated a greater number of errors in responding. In another comparative study, Hershey, et al. (1965), conducted an experiment designed to look at the effects of observations in a real class, compared with simulated teaching (students teaching other students) on: course grades, final exam scores, attitudes, career plans, ability to apply psychological principles, and general course satisfaction. While he found no significant differences between his training conditions, his subjective evaluation was that the live observations had a more general benefit, while the simulations were better suited for the development of particular, specific skills.

The degree of fidelity that is optimal for effective simulations has been a question of interest to several researchers. Guetzkow (1962), in summarizing simulations developed in military settings, concludes that "In general, (these) experiments ... show that high fidelity simulations ... are not necessary for high positive transfer." (p. 40)

One of the more systematic investigations of the effects of fidelity in simulations was conducted by Bert Kersh (1965). Kersh studied the following dimensions of what was called "realism:" (1) image size: life sized vs. small (2) feedback mode: visual vs. verbal (3) response mode: enactment of responses vs. verbalization of response, and (4) orientation to simulation: large life sized projections vs. small projections. Various combinations of simulation conditions were tried, ranging along a dimension labelled "realism." The most "realistic" training conditions were those in which the trainees received life sized projected materials during their orientation sessions, and enacted responses to life sized projections of problem situations. At the other extreme, students receiving "non realistic" training had an orientation consisting of small images, then responded to situations presented by slides, on a small screen, by verbally describing what they would do.

Students undergoing simulation training under varying conditions ranging from "nonrealistic" to "realistic" were compared in terms of performance on a post test consisting of response quality to simulated situations. Kersh found no significant differences on most of the variables he examined, with the exception of the large versus small sized projections for orientation. Here, he found a slight difference in favor of the small sized "nonrealistic" mode.

His overall conclusion was that "realism" was of relatively minor importance. An interesting sidelight to this study was that further analysis uncovered the fact that all subjects were able to achieve the same level of performance regardless of entry level. It appeared that simulation could have equalizing effect in bringing students with with widely varying backgrounds to similar levels of attainment.

Using the Kersh materials, Twelker (1965) investigated the effectiveness of various types of prompts given to subjects as they proceeded through simulation training. In this study, two types of prompts were compared to training with no prompts. In one treatment, subjects were given prompts which would help to identify the problem presented in the simulated episode, in the second, subjects received prompts which would help them generate a correct response. The prompts were of a general, rather than specific nature. Training including one or both types of prompts was compared with that in which no prompts were presented. Dependent variables included training session length, post test performance, and affect. Twelker found that "problem identification" prompts had unmeasurable effects. The "response" prompts had the effect of shortening the time necessary for trainees to reach criterion.

In summary, it's not surprising that dimensions of realism have been studied. It may, however, be surprising to some, that the "realism" or fidelity of a situation has not been demonstrated to have universally any strong effects to date. Perhaps the important "reality" factor for those simulations designed to develop cognitive abilities is less related to the form of the stimulus materials than to the form of the essential decision-making dynamic which underlies the simulation process. To my knowledge, this "cognitive realism" has not been explored.

It is also not surprising that some varieties of prompting would be effective in view of the value they have demonstrated in other media-related studies. Insofar as presentation variables are concerned, research on "classroom simulation" to date would seem to indicate that the fidelity of the presentation materials may not be as important as variables related to the instructional process, such as prompting.

Cognitive Outcomes

At this point, let us turn to studies focusing upon the outcomes of simulation training. Three broad categories of outcomes will be considered. In the first, the lower levels of the Bloom (1956) Taxonomy, "knowledge and comprehension" will be emphasized. The relevant question here is whether simulations can teach students facts, principles, and responses. The second level, which roughly corresponds with the "analysis" level of Bloom, deals with outcomes related to the discrimination of cues, and the identification of problems. Finally, the third category will be concerned with those studies which have explored the extent to which simulations have led to Bloom's "application" level, or transfer of what was learned into actual classroom settings. It is perhaps this latter category which is the most important, because it speaks to a major reason why simulations are claimed to be used: to increase one's ability to respond appropriately in actual settings. Perhaps this is why the great majority of the studies deal with the application, or transfer question, a comparatively smaller number deal with knowledge and analysis.

We begin our review with a consideration of those studies which have looked at the Bloom "knowledge and comprehension", levels. Cherryholmes (1966) after reviewing six simulation studies, rejected the hypothesis that students would learn more facts, and retain them longer using simulations as compared with "conventional classroom activities." Coleman (1973) reported contrary findings in that he found that students using simulations had an increased ability to learn facts.

When we turn to the matter of learning specific responses, the data are more clearly positive. Both Twelker (1965, 1970) and Kersh (1965) reported that students were able to learn "correct" responses during training, and exhibit them later on post tests. Since they presented problems novel to the students, these post tests could also be considered as tests of transfer as well.

Moving up the Taxonomy to "analysis," five studies will be reported. Kersh (1965), and Twelker (1965), found that their original classroom simulation materials were effective in teaching students valuable cue discrimination skills. Students were able to pick out the information necessary to identify the problems which were presented.

Similarly, using variants of the Kersh materials, Girod (1969) reported that his subjects were increasingly able to discriminate cues necessary to identify simulated problems. However, in contrary findings, Vlcek (1966) reported that simulation did not demonstrate any greater ability to develop problem identification skills when compared with no training at all. This was true regardless of whether the problems were presented via simulations, or in actual classrooms.

This brings us to the studies which have explored the applicability, or transfer of simulation training to actual settings. Kersh (1965), investigated the transferability of simulation training to actual classroom practices. Unfortunately, he had to abandon his attempt to answer this question because: (1) there was a one year interval between the time his subjects received simulation training and when they were in actual teaching situations, (2) he had no readily available instrument through which he could measure simulation's effects in a classroom, and (3) he had no control group against which his simulation trained students could be compared. Although he was unsuccessful in measuring the extent of transfer, he did circulate a questionnaire to supervising teachers which revealed that students having had simulation training were judged as being able to take over classes weeks earlier than students who had not received such training.

In a field test of Kersh's materials at Michigan State University, Vlcek (1966) reported that students undergoing simulation training, as opposed to students having no such training, were more able to solve simulated problems, but were not better problem solvers in actual classrooms.

Using a set of materials entitled the "Brockport

Simulation," Broadbent (1967) reported informal findings indicating that simulation students developed increased problem solving abilities. Likewise, Ryan (1965, 1968) found that when students solved problems presented via simulations, they exhibited an increased ability to solve problems in real settings. She concluded that practice in problem solving under realistic conditions should be given, particularly in specially created situations where students could apply their newly acquired knowledge.

Using the Kersh materials, Twelker (1965) found that students were able to learn and apply correct responses to new situations presented via simulations. Later, in reporting the results of his field testing of the "low cost" simulation materials, Twelker (1970) indicated that although he was not able to demonstrate that his system changed the classroom behavior of student teachers, he was encouraged enough to speculate that:

> It is heartening to note that the research of Forgan (1969) supports the intuitive hunches that simulation bridges the gap between the textbook and the operational situation. In fact, the ability of the system to change behavior in the classroom leads this writer to speculate that the objectives stated in

> Chapter II may be too rigid ... and should be relaxed... (p. 101, 102)

Emmer (1970) studied a peer teaching simulation experience to see if benefits would transfer to the teaching of actual pupils. He determined that transfer did indeed occur. Similarly, Zuckerman (1979) investigated transfer with his simulation program called "Hey Teach." Preservice teachers were given practice in four areas: (1) administrative tasks, (2) planning tasks, (3) implementation of instruction, and (4) classroom management. Informal reports from supervising teachers were that students who had received the "Hey Teach" program were better able to handle real classroom tasks.

Although the following study did not specifically deal with simulations used in teacher training contexts, they are included here because of their great general value. Both Coombs (1978), and Coleman (1973), summarize the long term, systematic research program in simulation/games carried on by the Center for Social Organization at Johns Hopkins University. After reviewing this extensive body of research, Coombs (1978) concluded that: (1) simulations can transmit factual information, but not better than other modes, (2) simulation does not seem to be a particularly good way to teach cognitive skills, (3) simulation games alter the character of a class in a positive manner, and (4) simulations improve the motivation of students.

In summary, we find that when simulations are used to instruct students in factual information, the evidence is mixed regarding their effectiveness. However, indications are that simulations can develop the capacity of students to give specific responses. Similarly, although by no means overwhelming, the experimental findings suggest that simulations can be successful in teaching problem identification skills. Turning to transfer in problem solving, we find most of the studies indicating that simulation is effective in leading students to greater problem solving abilities.

Affective Outcomes

Affective responses to simulation training have also been widely studied. These fall into three categories: (1) attitudes toward the simulation instruction, (2) attitudes toward the subject of the simulation, and (3) attitudes toward self.

With regard to attitudes toward simulation instruction, in his review comparing six simulation studies with "conventional classroom activities," Cherryholmes (1966) asserted that students participating in a simulation exercises showed more interest in instructional activities, and more readily had significantly altered attitudes.

Cherryholmes' findings were later confirmed by Cruickshank (1966), who, after studying forty students receiving 31 simulated critical incidents during the first two weeks of student teaching, reported that students reported greater satisfaction and ability to cope with teaching problems and preferred the (simulation) laboratory to starting student teaching two weeks earlier.

Similarly, Broadbent (1967) reported that students who had completed his "Brockport" simulation program rated it favorably, and "learned about themselves, their methods of reacting to attacking problems, and their relationships to students." (p. 42)

Reporting contrary findings, Twelker (1970), found some difficulties with his low cost simulation materials in their ability to hold the interest of students. He concluded that "The ability of the system to attract and hold the interest of the target audience seems marginal." (p. 99) However, he also noted that attitudes were not unfavorable. "It could be concluded that although there is room for improvement, affect was not negative." (p. 99)

Buehning and Schieman (1983) concluded that through their classroom simulation for music teachers, "we produced a simulation that was both highly motivating for the participants and instructionally meaningful." (p. 55) In an article entitled "Changing Attitudes with the 'School game,'" Plummer (1973) reported that this simulation exercise "generated positive affect." (p. 46) However, although the students seemed to enjoy the exercise, they did not view it as one which provided learning.

In agreement with most of the research, Hershey et al., (1965) measured student affective responses to "simulated" teaching (students teaching other students), and concluded that student satisfaction with the course was enhanced through simulations.

Harper (1980) took the novel approach of teaching an entire graduate course through simulations. He noted several advantages, among which was a "high degree of student involvement." Moreover, he reported that his students rated the simulation course over lecture versions.

However, he also noted that some individuals were very critical of the simulation course.

A study by Bond (1965) investigated the effects of classroom simulation on the attitudes of education majors toward topics in educational psychology. He reported "In general, the findings of the project are not sufficiently conclusive to permit any clear cut recommendations of procedure on the use of simulation to influence attitudes of education majors toward professional course content." (p. 17) However, he also indicated that informal statements of evaluation justify continued research in the area.

In his evaluation of the Hopkins Game Program, Coleman (1973) concluded that students undergo a change of attitude toward the real life persons whose roles they assume in the simulation. This change of attitude is positive, but may be short lived. The more concrete the simulation game, the more strongly the attitude change effect seemed to be.

Two researchers found an enhancement of a student's self confidence as an effect of simulation training. Vlcek (1966), using Kersh's materials, found an increase in the self confidence of student teachers. Similarly, in a much more recent study, Schieman and Winn (1983) reported that among other advantages of their system, students had increased confidence in their teaching ability. Finally, studies by both Broadbent (1967) and Hershey, et al., (1965) reported increases in student "self knowledge" coming from simulation training.

In summary, I report that the overwhelming evidence points to a high degree of student satisfaction with simulaton training. With few exceptions, students report favorable attitudes toward simulation. The studies are somewhat less clear on whether these favorable attitudes extend to entire courses, subject matters, and even perceptions of subject content areas such as educational psychology. Simulations do appear to have the potential of developing favorable attitudes toward any roles and positions simulated. Finally, students report increased self-knowledge and self confidence accruing from simulation training.

Conclusions From the Research

Before any conclusions can be drawn from these data, some important qualifications should be noted. First, the studies cited represent a mix of methodological approaches. Many reported findings are "informal." Furthermore, although classroom simulation has been studied in several different contexts, few efforts have been attempted to systematically, and over a long term, investigate variables connected with the technique. For these reasons, any conclusions must be viewed as tentative, certainly not definitive. With these reservations noted, I list the following preliminary conclusions:

1. Simulations have the potential of developing the capacity of students to learn specific responses to given situations.
2. Simulations have the potential of developing the capacity of students to identify and solve problems.
3. In the design of simulation, factors related to the physical fidelity of the materials to the physical situation may be less important than the degree to which the simulation models and exercises students in realistic problem solving processes.
4. Simulations are costly to produce, but do have a potential for efficient, low cost applications, particularly when delivered via interactive video formats.
5. Students enjoy simulation exercises.
6. Students report higher levels of self understanding

and greater confidence after receiving simulation training.

After reviewing the studies of simulations used in teacher education, my overwhelming impression is that many more questions are raised than are answered. Some of the questions for future research will be given in the final section of this report.

RATIONALE

We have seen that simulations have been successfully employed in many different teacher education applications. We have also seen that the development of simulation materials can occur within a framework drawing upon several learning and instructional theoretical perspectives. Finally, the research conducted to date, while spotty and incomplete, does suggest that simulations can be used successfully in the development of higher level cognitive abilities, notably problem solving, and that simulations are viewed favorably by students.

In his now classic work entitled "Readiness for Learning," Bruner(1960) characterizes the instructional process as proceeding through three phases: acquisition, transformation, and evaluation. Briefly, acquisition concerns precisely what the name suggests, the acquisition of information. This correlates to the lower two levels of the Bloom (1956) taxonomy. During this phase, the emphasis is upon the gathering, storage, and retrieval of information. In "transformation," learners "manipulate" knowledge to make it fit new tasks. In terms of the Bloom taxonomy, operations such as "analysis," "synthesis," and "application" occur. Finally, during the phase of "evaluation," learners judge whether the way they have manipulated information is adequate to the task. This corresponds with Bloom's "evaluation" level. Bruner indicates that "in the learning of any subject matter, there is usually a series of episodes, each episode involving the three processes." (p. 421)

In which of these phases might simulations most properly be employed? The answer is not absolute by any means, because simulations have been used to support all three. However, it is in the "transformation" and "evaluation" stages, that the greatest degree of success has been attained. At least, the literature discribing uses of simulations in teacher education contexts would suggest this. Simulations seem particularly suited to providing practice in cue discriminaton, and problem solving.

Put in the context of preservice teacher education, simulations might best be employed then, as a bridge between the facts, principles, and skills learned in educational foundations classes, and the experience of serving in an actual classroom as a student teacher, or intern. In reviewing the applications of simulations in teacher education, it is not surprising to find that this is precisely the point at which most simulations have been employed.

Simulations are useful not only for preservice, but inservice teacher education as well. Here, practicing teachers may have opportunties to try out new instructional procedures, and sharpen their discriminatory skills in simulated settings. Again, the "transformation" and "evaluation" phases as described by Bruner seem to be appropriate points in the learning process to employ simulation.

Might we conclude that simulations have no place in the initial acquisition of information? Not necessarily, although few, if any, examples of the technique being successfully employed in such settings, at least in teacher education programs, seem to exist.

Turning to the design of simulations, we find that their optimal format seems to be related to the nature of the objectives connected with instruction. At least in teacher education, we have some evidence that high degrees of fidelity of stimulus situations may not be as crucial a factor in designing successful simulations as faithful replication of problem solving processes. Therefore, "reality" may be presented via small screens, and subjects may not be required to act out their responses as if in the actual situation. Insofar as the problem solving process is exercised, simulatons might be successfully presented by video and require verbal or written responses.

It is important to note, however, that the episodes must be believable, if not projected in life sized images. Believability requires that the problems be realistic, that possible decisions be reasonable, and that sufficient information be available for decisions to be made. Furthermore, the feedback to the learner must be such that there is little question that such feedback would indeed occur in the real situation. It is, then, the integrity of the materials which is most important. The integrity and "reality" of the decision making process which seem essential for a successful simulations.

As is true for most instructional materials, the evaluation of simulation training systems should include both cognitive and affective elements. In the cognitive area, any factual material which is presented, and which the student is required to remember, should be measured to see if it is presented in a clear fashion. Similarly, if cue discrimination is an objective, this should be measured as well. Most simulations are designed to exercise students through problem solving strategies, so the degree to which the materials develop problem solving skills should be considered. A simulation is supposed to lead to improved performance in actual situations, so tests of transfer to actual settings should be included in most evaluations of simulation training. As in virtually any training package, attention should be paid to the objectives when designing evaluation instruments.

Similarly, affective outcomes should be a part of regular evaluation. Here, the student's attitudes toward the simulation training situation, and toward the general disciplinary content should be monitored.

The feasibility question becomes important in many, if not most, applications of simulations. The costs for developing and operating simulations should be monitored, with procedures and techniques for reducing them thoroughly explored.

A CASE STUDY

Last winter, I set about to develop some simulation materials for use in the preservice teacher education program at Seattle Pacific University. It was, and remains, my hope that a continuing, systematic program of research and development in simulation will be undertaken at Seattle Pacific, and that the present materials represent the very first beginnings of that program.

This case study will summarize the development of a prototype classroom simulation system, from initial development, through field testing. It is hoped that it will serve to illustrate, in a concrete way, the way in which simulations can be developed and used in higher educaton. This account will be given in five parts: (1) a description of the background situation, (2) questions to be answered, (3) a description of production techniques, (4) a description of the field testing, and (5) the results and conclusions.

The situation.

The materials were developed for use at Seattle Pacific University, an independent institution enrolling approximately 2500 students, located in Seattle, Washington.

Specifically, the simulations were developed for use by preservice Education students engaged in their internship program. The content of the simulations was focused on classroom management techniques for two reasons. First, it was determined that this was an area in which interns could use some additional training, and second, I had access to the classroom management principles which had been developed for Twelker's "low cost" simulation package described earlier. These classroom management principles had beed developed after a careful review of the literature, and represented a thoughtfully developed, systematic approach to classroom management. I secured permission to use the earlier content materials virtually intact. Much saving in development time was thereby attained, as this content could be used with little modification. The simulation materials were designed to exercise students in the use of the following three principles of classroom management: (1) If students are about to begin an activity where rules and standards of conduct have not been established, the teacher should establish such rules and standards; (2) When students violate the rules and standards in ways that are not disruptive of others in the class, the teacher should act in a non-disruptive manner; and (3) When students are violating the rules and standards in a disruptive way, the teacher should act with enough forcefulness to end the disruption.

The University had acquired several interactive video stations, consisting of Apple and IBM microcomputers connected to Panasonic AG 6200 videotape recorder/players. In addition, the Professional Authoring Software System (PASS) developed and marketed through the Bell & Howell Company was available for software development. The PASS materials allowed the development of branching computer managed instruction programs, incorporating video sequences.

In addition, the University had half inch, VHS format video recording and editing equipment available through its Instructional Media Center. I was experienced in the use of this equipment, having produced a number of video programs for educational use in the University. Further, I had access to a fifth grade classroom, as one of my graduate students volunteered her class for the taping.

Questions to be answered

In developing the materials, I had three different kinds of objectives. The first, and most important, was to determine the degree to which the equipment and software would allow the development, and reliable delivery of simulations through an interactive video format. These feasibility considerations could be stated as:

1. How much will it cost, in time and materials, to develop the materials.

2. Will the PASS software allow the degree of flexibility necessary for successful simulations?
3. Will the interactive video system be sufficiently reliable to allow the materials to be used in an individualized mode?
4. Will the instructions and procedures be clear and manageable for students to proceed independently?

The second type of question related to the content of the simulations. If the hardware and software systems worked, would the students gain anything of value from having gone through the simulation training? Because the materials which were developed were experimental, and because only four episodes were included, the relative amount of training in the content was rather limited. How much cognitive learning of the materials could be expected from such materials? Specifically, the relevant questions included:

1. Will the students "discover" and apply the classroom management principles as they interact with the situations?
2. Will the students be able to state the principles of classroom management two weeks after they have completed simulation training?

The third and final question concerned the question of affective student response to the simulation training. Specifically, it was: Do the students enjoy participating in the simulation exercises?

Production of the materials

Production of the prototype materials proceeded along the following stages: outline of content, flow chart, scripting, taping, video editing, CAI authoring, and initial test.

Outline of Content: It was decided that the materials would have two main sections. In the first, an introduction to classroom simulation project would be presented on video in the form of a mini-lecture. Here, the students would be informed about the general content of the package (classroom management), and would be introduced to the concept of simulation delivered via interactive video.

In the second section, the students would engage in the simulation itself by responding to four simulated classroom incidents designed to give them practice in using the classroom management principles. First, a stimulus situation would be presented via video, with the "stage being set" through audio overdubbing. After the problem had been presented, the computer would direct the student to generate a response: "What would you do in this situation?" After the student had responded, the computer would display multiple choice options, asking the student to match the response they had made with one of the choices. After making the choice, a video sequence would be displayed showing the probable student response to that choice. Following the video sequence, the computer would deliver a text screen interpreting the feedback sequence to the student. If the response was correct, the student would move on to the next episode; if the response was incorrect, the student would be re-cycled through the original problem sequence again. Re-cycling would continue until the correct response was selected. It is possible that students might go through any episode as many as four times, as four choices of response were given.

In the final section, the principles would be summarized in the form of another mini-lecture delivered via video. In addition, the student was directed to rewind the tape, turn off the equipment, and prepare the interactive video station for the next user.

Flow Chart: A flow chart was developed, illustrating all of the branching possibilities. Please refer to the flow chart in the appendix.

Scripting: A script was developed for the introductory and final mini-lectures. The content was taken directly from the "low cost" simulation materials. No scripts were prepared for the simulation episodes. Rather, general descriptions of situations were prepared.

Taping: On the appointed day, the simulation stimulus situations, and the feedback sequences were videotaped in an actual fifth grade classroom. The children did not memorize scripted material, rather, the situations were described and they were asked to respond "naturally" as if the situation had actually occurred. If anything was said, they were directed to make responses in their own words. I was directly involved in the filming of Kersh's classroom simulation materials in the early sixties, and remembered that in that situation, the approach described above proved to give the most natural appearing sequences. The technique worked satisfactorily again, most individual sequences were taped in fewer than five takes, many requiring only one or two.

Video Editing: After the situations were taped, the mini-lectures and the situations and feedbacks were edited to a VHS format tape which would be used in the interactive video simulation program. To minimize tape travel and thereby save time of video access, the most probable feedback sequences should have been edited to imediately follow the relevant stimulus situation. However, in the case of the prototype materials, no basis for judging which response would be most probable could be determined. Therefore, the "correct" feedback was placed immediately following the stimulus situation.

CAI Authoring: The Bell & Howell PASS system was studied and learned in sufficient depth to create the materials. This authoring system has a "prompted" and "nonprompted" versions, the former being somewhat easier and faster to learn. In the development of the materials, it was necessary to learn the procedures of the "nonprompted" version to complete the necessary programming. Text screens, and branching commands were developed and entered in a lesson called "CLASS."

Initial Test: After the CAI and video materials were developed, they were combined for a first trial. In a dissapointing turn of events, the system failed to start and stop the video sequences at the correct points. Initially, the tape had been edited to have an approximate five second "window" at the beginning and end of each sequence. It was thought that this would be sufficient to correct for error in tape addressing. Unfortunately, this assumption proved to be incorrect. The tape was re-edited to have a fifteen second black segment at the beginning and end of each sequence. This proved to allow enough time for address error.

It became apparent that the error of tape addressing was a cumulative one. That is, each error was added to the next, so that after several stops and starts of the tape, the error became large enough to render the video unusable. This was corrected by having the video sequences automaticaly re-calibrate themselves after two episodes. This procedure, while making the video segments more accurate, had the disadvantage of creating a lengthy wait period for students while the calibration process occurred. In spite of the necessary adjustments of the system, a satisfactory prototype set of materials was finally completed.

Field Test

An Apple/Panasonic interactive video station was moved to my office so I could observe, at close hand, how the system worked as individuals interacted with the materials. A sign up sheet was prepared with time slots for twenty students. Interns were encouraged, by their supervisor, to sign up for the simulation sessions and met some optional course requirements by doing so. More than twenty "volunteers" signed up for the simulation sessions.

When they arrived, the materials were described in general terms, then the students were directed to proceed. They were also encouraged to ask questions at any time, and to write comments on the written response forms. I made myself available for easy access to the students as they engaged in the simulation materials. Their verbal comments were recorded for later analysis. All of the students completed the simulation training.

Results and Conclusions

A number of questions were posed at the outset of the development of the prototype materials. Results will be reported in terms of these questions.

1. How much will it cost, in time and materials, to develop the materials.

   It took approximately 100 hours to develop the materials to the prototype stage. However, it should be noted that no time was required for content development as the "low cost" materials were adapted to the current project. costs of developing the materials were, of course, related to development time. In addition to this, material costs for tape, diskettes, paper, supplies, etc., was approximately $50.00. For those interested in costs of hardware and software already on hand, it is estimated that the total cost for necessary hardware and software, including the video equipment, and assuming one interactive video station, amounts to approximately $15,000.

2. Will the PASS software allow the degree of flexibility necessary for successful simulations?

   The PASS software did permit adequate flexibility to develop the materials. Limitations were noted not in the CAI software, but in the nature of the interactive video tape system.

3. Will the interactive video system be sufficiently reliable to allow the materials to be used in an individualized mode?

   No reliability problems occured with the field test. The equipment operated flawlessly.

4. Will the instructions and procedures be clear and manageable for students to proceed independently?

   Instructions and procedures were clear enough for most of the students to follow. Some minor changes in wording were indicated. Few questions related to the instructions or procedures were noted.

5. Will the students "discover" and apply the classroom management principles as they interact with the situations?

Preliminary indications were that students were able to "discover" and apply the principles on three of the four episodes. In one case, the stimulus situation proved to be too ambiguous to elicit a response in a a number of cases. This is not a fault with the content, but rather with the way in which the stimulus situation was presented, and can be corrected in subsequent versions of the materials.

6. Will the students be able to state the principles of classroom management two weeks after they have completed simulation training?

   Testing for knowledge of the principles is scheduled for February, 1986.

7. Do the students enjoy participating in the simulation exercises?

   No formal measures were taken of student affect with the materials. However, most of the students indicated satisfaction and enjoyment in unsolicited comments as they completed the materials.

I concluded that the The prototype materials were successful. The major difficulty with the system was the time "wasted" while the video segments were located. This problem may be corrected by including provision in the materials for the students to be doing something, responding, reading, etc., while the video sequence is located. In this way, these interruptions in the flow of the lesson can be minimized.

FUTURES

The main limitation of the interactive video system described in this paper relates to the fact that the video is tape based. Random access video disc would eliminate most, if not all of the problems of inaccurate tape access, and tape transport time. However, at the present time, production of video discs is very costly and not within the means of many potential local producers, including myself. Promising developments in video disc technology indicate that production costs may, in the near future, become low enough for local production of the type described in this paper, however. In my opinion, the advent of low cost video disc production will lead to significantly improved interactive based simulation systems.

Perhaps of greater importance than hardware refinement will be the growth of a research base from which effective and efficient simulations can be specified and designed. In reviewing the research literature on simulation in general, and teacher education applications in particular, I was impressed by the value derived from longer term, systematic research programs, such as those conducted by Johns Hopkins in game research, and Teaching Research Divsion of the Oregon State System of Higher Education's classroom simulation research. I would agree with Tansey (1970) that "later workers (in simulation) owe a debt to Kersh, Twelker, and Cruickshank." (p. 300) This is not to deny the value of individual experiments, because they do provide relevant and useful information. However, it is when variables are systematically explored, when experiments can be replicated, and when complex interactions among treatments and subjects can be explored in repeated studies, that the much valuable and reliable information can be gained.

With this sort of programmatic effort in mind, I would propose a research agenda in which variables are systematically explored as follows. Variable categories, each with three illustrative examples are provided.

Stimulus variables

* Value of positive vs. negative examples.

* Value of various types of prompts and cues provided at various points in the simulation.

* "Realism" fidelity of the simulation to the underlying cognitive processes being simulated.

Response variables

* Individual vs. group response
* Real time vs. delayed, contemplative response
* Constructed vs. selected responses.

Sequencing variables

* Simulations location within larger instructional systems: beginning, middle, end.
* Optimal length of simulation training related to larger instructional system.
* Value of simulation for "acquisiton," "transformation," and "evaluation" phases of the learning process.

Content variables

* Ability of simulations to facilitate attain cognitive outcomes at all levels of the Bloom Taxonomy.
* Ability of simulations to effect attitude change.
* Relationship of varying simulation techniques to varying content areas.

Subject variables

* Effectiveness of simulations with varying learning styles of students.
* Effectiveness of simulations with varying ability levels of students
* Effectiveness of simulations with students posessing varying amounts of background information in a given subject.

General variables

* Effectiveness of simulations used in connection with group vs. individualized instruction.
* Effectiveness of simulation used in inductive vs. deductive instructional sequencing.
* Effectiveness of simulations used in connection with other, specific instructional approaches.

Variables such as those suggested above, should be investigated individually, and in experiments designed to examine interactions among them. A thoughtfully developed research agenda, particularly one which followed a particular learning and/or instructional theory, conducted over an adequate period of time, would provide significant benefits for future developers of simulation materials.

The simulation technique has shown itself to be an effective training mode, in some situations uniquely valuable in achieving cognitive and affective outcomes. With increasingly affordable and sophisticated hardware and software, this approach promises to add much to our ability to develop effective instructional programs. A systematic, long term research effort will help future developers to use simulations in their most effective and efficient manner. It is interesting to note that, in a recent address to the

Harvard Board of Trustees, President Derek Bok (1985) waxed eloquent about the potential benefits of simulations in promoting "active learning" in higher education. Simulation is an educational technique whose time has finally come. Let us exploit this valuable instructional technique to its greatest that we may be of greatest service to our students.

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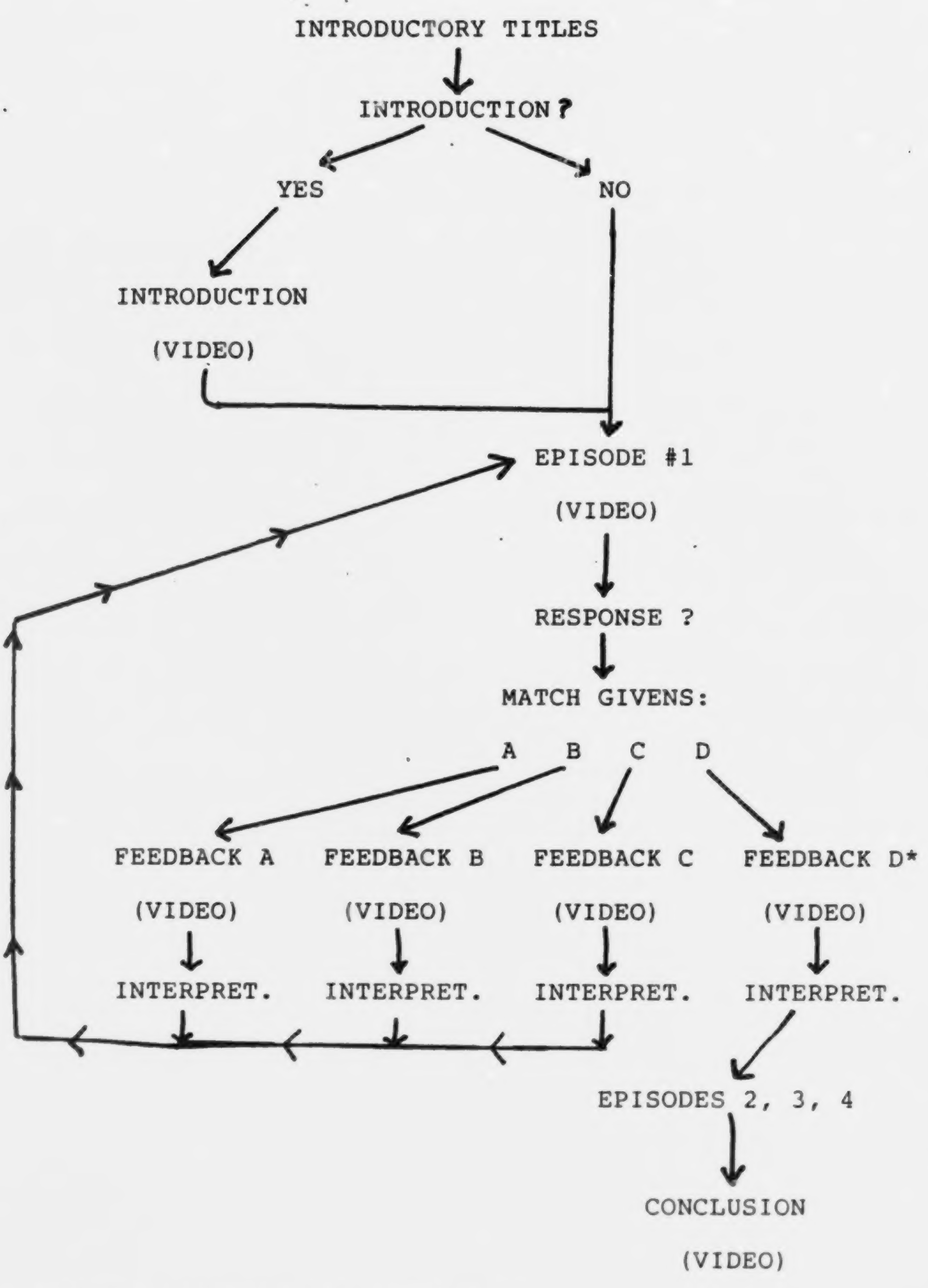
Appendix A: Flow chart of interactive video prototype.


INTRODUCTORY TITLES
INTRODUCTION ?
YES
NO
INTRODUCTION
(VIDEO)
EPISODE #1
(VIDEO)
RESPONSE ?
MATCH GIVENS:
A
B
C
D
FEEDBACK A
(VIDEO)
INTERPRET.
FEEDBACK B
(VIDEO)
INTERPRET.
FEEDBACK C
(VIDEO)
INTERPRET.
FEEDBACK D*
(VIDEO)
INTERPRET.
EPISODES 2, 3, 4
CONCLUSION
(VIDEO)

* ASSUMES RESPONSE "D" IS CORRECT.

"Newscast From the Past": A Dynamic New TV Series with a Global Perspective on World History

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What if you had a special television set that you could turn on to see Joan of Arc in full battle regalia leading the French into battle, or Galileo sighting the moons of Jupiter in that new invention the telescope, or Martin Luther arguing with Church authorities about the sale of indulgences? Would you tune in?

Few would be able to resist such an opportunity to peer into the past. The closest thing to such a device is currently available to teachers on the "Newscast From the Past" television series. The Black Death sweeps across Europe, Gengis Khan's barbarians terrorize the peoples of Asia, Copernicus proposes the radical idea that the sun is the center of the solar system, Hernando Cortez marches upon the mighty Aztec Empire with his small band of Spaniards, and Mughal emperor Shah Jahan constructs the magnificant Taj Mahal in memory of his beloved wife.

Each of the six programs encapsulates the events of a given century as if it were a fifteen minute evening newscast. The telecasts are delivered by an anchorman and a team of "on-the-scene" reporters, covering their stories from remote corners of the world. They include interviews with famous figures, dramatic moments in history captured on tape, "human interest" stories, debates on significant issues of the time, and even some commercials for new products of the day.

While reminiscent of Walter Cronkite's "You Are There," the "Newscast From the Past" differs from this previous series in several key respects. For a full half hour, "You Are There" focused upon a single major event from the relatively recent past, usually an incident from American history. It approximated the documentary genre more closely than it did the television news. On the other hand, "Newscast From the Past" more closely imitates the news telecast format, and it deals with worldwide events in the medieval period. Although its treatment of specific events is more superficial than the coverage was on "You Are There," the scope of "Newscast" is far more global and the breadth of history that it encompasses is far more extensive.

"Newscast From the Past" was produced at KLRU-TV, the Public Broadcasting Service affiliate in Austin, Texas. It was funded by the Corporation for Public Broadcasting and the National Endowment for the Humanities. The series was written by a team of scriptwriters and historians, who carefully monitored its content for historical accuracy. The final scripts were also mailed to reputable historians across the nation to doublecheck their accuracy. The program's six figure budget was large by educational television standards, and the production has a very professional look. A feature film director was placed in charge of the shooting, and he successfully orchestrated a set of convincing performances on sets filled with realistically medieval looking paraphernalia.

The high quality of this production was acknowledged by educators across the country during the so-called "Firstview" sessions, conducted by the Public Broadcasting Service to determine what programming should be made available on the school instructional television schedule. "Newscast From the Past" was voted first in this poll, as the new program that most deserved to be placed on the schedule. Furthermore, because it was produced with Corporation for Public Broadcasting funds, "Newscast" will legally be in the public domain for three years. This means that PBS affiliates will not have to pay the usual fees to broadcast it. "Newscast" is therefore a high quality bargain for local PBS stations, and consequently it is being widely aired throughout the country.

Public domain status also means that the programs can be videotaped off the air and used for instructional purposes from now until the end of the 1988 school year, without any of the usual copyright restrictions. Videotape distribution of the series will be forthcoming in the near future. A forty page teachers' guide to "Newscast" is available for $2.25 from KLRU-TV in Austin, Texas (see the address at the end of this article). Already over 15,000 of these have been distributed to state education departments and public television stations throughout the country, from New Jersey to California and from Alaska to Texas.

The Problematic Nature of World History Instruction

A survey I conducted a few years ago revealed abysmally low percentages of high school students able to identify twenty of the most influential figures in history on a simple matching exercise.[1] These twenty men were taken from a list that included Jesus Christ, Sir Isaac Newton, Mohammed, Buddha, Confucius, Einstein, Marx, and Columbus.[2] Why is it often so difficult to interest adolescents in world history?

Unfortunately, history is often taught with an emphasis upon obscure facts and figures. Why should today's teenagers be expected to memorize the precise year of the Council of Trent, the victor of the Battle of Tours, or the site of the Magna Charta signing? World history can become a "trivial pursuit" when it should be a meaningful one. While probably more worthwhile, the conceptual approach to history instruction may be no more inspiring. Lengthy lists of causes and results can remain meaningless abstractions to pupils unless they have carefully studied the circumstances involved.

Ideally, historical study will move students through several stages of awareness. First they will learn what took place (perhaps even exploring the difficulties encountered by historians in trying to establish what actually did transpire). Next they will assimilate and synthesize this material, so that they can begin to understand why events unfolded as they did. Then students should start to draw their own conclusions about the past. Finally, they will hopefully apply what they have learned to present day situations. The lessons that history has to offer should help young people develop their own political views, and empower them to make thoughtful decisions based upon an expanded awareness that ranges far beyond the limits of their own personal experiences. Yet none of this personal growth will occur if a student is not interested in the historical events themselves. Motivation is, therefore, a critical issue.

What can excite students about the study of history? One successful approach is to relate fascinating stories about personalities of other eras and faraway cultures. History can captivate in the same way that literature does, (and it possesses the added allure of having really happened). But a solid history course must also be more than a scholastic "Ripley's Believe It or Not." It will hopefully convey some sense of what life was like in previous times. Like fine literature, it should transport the student into other worlds. Teenagers can imagine themselves in the stately Roman forum, the opulent court of Louis XIV, a clammy dungeon during the Spanish Inquisition, Magellan's weathered galleon, etc.

For most high school history students, it is very difficult to accurately picture such scenes, because the information provided by the textbook is so limited. In trying to survey all of human history, descriptions of previous eras are sketchy at best. Some teachers can bring certain historical periods to life, but in many cases, pupils remain bored with the subject because they cannot relate to it. Yet these same students will sit for hours in front of their television sets at home, watching Marlon Brando play Mark Anthony, Napoleon, or Fletcher Christian.

As John Dewey so often asserted, experience is a critical factor in a young person's education.[3] Film and television have the capability of re-creating the past, and thereby provide vicarious experiences that involve the learner. It is in this capacity that "Newscast From the Past" can make a significant contribution to a world history course. To see how effective the series may be in this regard, a survey was developed.

The "Newscast" Survey

How effective has the use of historical drama on film (or videotape) proven to be in social studies classrooms? The general instructional efficacy of film and television in the classroom has been well documented in a variety of research studies, dating back many decades.[4] In fact, respected media researcher William Allen wrote in the late 1950's, that, for factual material, "in about 85 percent of the studies comparing motion picture teaching with conventional methods, films were found to be significantly superior."[5]

The landmark studies into the use of films in history classes were conducted many years ago by researchers at Yale University. A 1928 study conducted in a junior high school American history class showed a filmed series of "photoplays" entitled, "The Chronicles of America."[6] A rigorous replication using the same films was carried ;out ten years later?[7] Both studies found significant learning gains for students who viewed the film series, over a control group that received conventional instruction. It was also shown that pupils who saw the films became more interested in the subject matter. More recently, studies on teaching history with televised material have yielded similar results. One carefully documented example was the favorable set of reactions to the classroom use of a television series entitled "American Cultural Heritage."[8]

However, the actual number of quantitative investigations conducted on the effectiveness of using film or television to teach history is rather small. As such, it seemed appropriate to test reactions to the "Newscast From the Past" programs. A survey was developed to examine a variety of issues related to the instructional potential of this series. How appealing is it to the primary target audience, high school world history students? How easily might it be included in the typical world history curriculum? How effective will it be in providing a more meaningful sense of history to young people?

The survey was distributed to 363 students from four high schools in the Midwest. While the student sample was not scientifically selected, there was an effort made to obtain a representative crossection of students by including four distinctly different types of schools in the study. These sites included an upper middle class suburban school, an inner-city magnet school, a parochial school, and a vocational school. Students were given a series of statements about the show, and were asked to respond to each on a Likert scale. Scores were averaged for each item. Tabulated results are listed in the table of "Survey Ratings."

Survey Ratings

Rating scale: 2 = strongly agree
1 = agree
0 = neutral,
-1 = disagree
-2 = strongly disagree

"Newscast From the Past" was entertaining.	1.01
Seeing historical events acted out was interesting.	1.24
Certain historical personalities "came to life" for me.	.55
The program did a good job of presenting the sights and sounds of the Middle Ages.	1.10

The TV news format helped make the historical events seem real (as if they really happened).	.99
History is more interesting when presented as if it is current news.	1.14
I was amused at the idea of historical figures appearing on a modern medium like TV.	.99
I feel that a series of programs like this would help make a unit on the Middle Ages more interesting.	1.34
I think that "Newscast" programs could conveniently be used along with the world history text my class is using.	1.19
The program provided some special perspectives on the time period because it portrays the era differently than the impression given in the textbook.	.55
I prefer seeing "Newscast From the Past" to reading about the same events in a book.	1.22
I would like to read more about some of the events reported on the show.	.21
The program provided some special perspectives on how dramatically the world has changed since the Middle Ages.	.95
The program provided some special perspectives on how some aspects of life on this planet never change.	.41
The program suggested some lessons that history has to offer.	.48
The newscast included some people whom I admire (and hope to fashion myself after).	-.33
The program provided some special perspectives on what was simultaneously happening all over the world during a given period of history.	.70

Historical Drama as an Instructional Approach

Historical fiction has always been a popular film genre, from Cecil B. DeMille's biblical extravaganzas to present day television "docudramas" about recent historical figures and events. The "Newscast" series uses this popular approach to portray famous moments and significant figures as accurately as possible. In doing so, it hopes to educate as it entertains. But the first issue is whether it succeeds as a dramatic production.

Students agreed with the item "'Newscast From the Past' was entertaining," which obtained a rating of 1.01. In this age of bloated budgets and slick video production techniques, it is no small accomplishment for an educational program to receive such a positive response from today's generation of adolescents, who are teased, titillated, and tranquilized by the media on a daily basis. An entertaining program, will, at least, tend to hold the class' attention, the first prerequisite for learning.

But getting a group of young people really interested in history is a difficult challenge. Adolescents are notoriously egocentric. Their concerns extend, at best, to an immediate peer group, but seldom beyond. Asking them to consider the tribulations of another society several centuries ago can be frustrating. Nor do young people often have a clear sense of their own personal history. In later adult life, we can reflect back upon the events and decisions that influenced our lives. Such recollections can take on a personal meaning for us, and an appreciation of one's own "history" develops. Yet, for most teenagers. these perspectives are years away. Furthermore, an interest in history naturally arises among members of the older generation, because they actually remember events now considered "historical." Young people have none of these advantages when it comes to finding meaningful lessons in the study of history.

Therefore, it was extremely encouraging to see that students felt very strongly on the survey that "Seeing historical events acted out was interesting" (rating of 1.24). This result alone perhaps should merit the use of "Newscast" in classrooms across the nation. Another issue, whether "Certain historical personalities 'came to life' for me" during the show, received moderate support (.55). In this case, the brevity of most of the appearances on camera may have limited the impact of these performances. Considerably greater support was given the statement, "The program did a good job of presenting the sights and sounds of the Middle Ages" (1.10).

If, during the show, students experience the "atmosphere" of medieval times, perhaps, ensuing discussions will be more meaningful to them. The deplorable standards of living, the vulnerability to disease, the widespread illiteracy, and other fundamental aspects of Medieval life are effectively portrayed in "Newscast". Students can begin to comprehend how their ancestors lived, and then place the events and issues of that period in the proper context.

In fact, perhaps this program can overcome some of the aforementioned problems that students have in relating to a previous historical era. It's often difficult for them to imagine what life was like, and consequently the lists of names and dates, causes and effects, winners and losers, and so on, remain dry abstractions. In viewing the newscasts, students felt that "The TV news format helped make the historical events seem more real (as if they really happened)" (.99). If "Newscast" successfully communicates the sense that the names in their text were living, breathing human beings who struggled with the challenges of life, just like the rest of us, then it has taken its audience through the first critical steps towards greater involvement. Teenagers can begin to contemplate how other people throughout history have dealt with life's problems, and, in so doing, may begin to reflect more carefully upon themselves, their own aspirations, their own strengths, their own weaknesses, and their own unique ways of dealing with the world.

The Newscast as an Instructional Format

"Newscast From the Past" takes advantage of an instructional format that young people have become accustomed to learning from. Many students in this study agreed with the survey item "I generally watch at least part of a nightly news program several times a week" (.54). The potential of the television newscast as an information source has been studied extensively in the past few decades. Well educated subjects have recalled detail on approximately fifty to sixty percent of the items on a news telecast,[9] although retention rates have been considerably lower for audiences tested under non-laboratory conditions.[10] Several studies have shown that the visual material provided on television news programs aids recall of information,[11] and that motion pictures are more effective in this regard than stills.[12] Viewers general overall knowledge of current events has been positively correlated with their ability to recall specific facts included in a telecast,[13] and those that watch newscasts in order "to become informed" recall significantly more than those who watch "casually" or "to relax."[14]

These findings suggest that a newscast style program has instructional potential in the classroom. Learning gains from news broadcasts have been rather significant under "supervised" conditions and classroom viewing is certainly supervised. Furthermore, "informed" viewers demonstrate higher learning gains than uninformed viewers, and attentive students in the middle of a history course would hopefully already be somewhat knowledgeable about the material from their readings and discussions.

Student reactions to the use of a news telecast format to depict events in world history were obtained on an number of survey items. The statement "History is more interesting when presented as if it is current news" attained a strong rating of 1.14. Is it the inherent appeal of the evening news format, with its fast paced mix of film footage and commentary that involves the student audience? This could not be the sole explanation, for the statement "I normally enjoy watching nightly news programs on TV" rated only a .32 level of agreement.

Perhaps, more significant is the novel twist that the "Newscast From the Past" series gives to this standard television format. The survey statement "I was amused at the idea of historical figures appearing on a modern medium like TV" received a rating of .99. Repeated observation of groups watching the show for the first time confirms this "novelty" factor, for the majority of faces in the audience invariably become animated as an historical figure is interviewed by a reporter.

Why should "Newscast From the Past" elicit such a pleasantly startled response from its audience? After all, people have long become accustomed to watching historical drama on television. It may be that the presence of modern telecommunications equipment in the "Newscast" scenes contributes to this phenomenon. Microphones are thrust at medieval personalities, creating an incongruity that probably intrigues the audience. This "reverse anachronism" upsets our established conceptions of historical reality. It has the same absurd effect as the "what's wrong with this picture" cartoons we enjoyed as children, in which one object does not belong in the situation.

These modern devices also suggest one of the most tantalizing fantasies of the present century: time travel. From the publication of H. G. Well's classic novelette The Time Machine to the release of Steven Spielberg's current hit film "Back to the Future,", the concept of time travel has increasingly come to captivate the public imagination. "Newscast From the Past" implies an accessibility to the intriguing events of the past via modern technology, a magic camera through which we can peer into past eras. This idea undoubtedly has considerable appeal.

Why else might history seem more interesting when presented as if it is current news? Naturally, people will tend to be more interested in today's events than those of the distant past because they are more likely to be affected by them. The public can become conditioned by media formats to react in certain ways, and they generally respond to newscasts with concern. In using this format, a "Newscast From the Past" may benefit from some of this mental conditioning. Through the reports of a news anchorman, the events of the past seem more immediate and compelling.

In addition, the newscast format may create a context that seems more "real" to the viewer than the average docudrama. While film narrative has traditionally been fictional, newscasts have always presented real incidents. The events portrayed on the "Newscast" programs may derive a certain degree of subconscious credibility from the fact that they are reported using all the normal conventions of a news program. This conjecture is supported by the strong agreement, mentioned earlier, with the statement, "The TV news format helped make the historical events seem more real (as if they really happened)."

"Newscast" and the World History Curriculum

Would the "Newscast From the Past" series enhance a high school world history curriculum? The survey item "I feel that a series of programs like this would help make a unit on the Middle Ages more interesting" received a rating of 1.34, the highest score on the entire survey. High school history students would very much like to see this series included as part of their coursework.

But did they feel that the programs could effectively compliment the material in their texts? There was clear agreement (1.19) with the statement "I think that 'Newscast' programs could conveniently be used along with the world history text my class is using." Five teachers surveyed on these two items also agreed with them (average rating of 1.00

on both this items and the previous one).

The "Newscast" series can be used in a variety of interesting ways in world history classes. But these programs would probably be best employed as an introduction to the study of various medieval centuries. They provide a stimulating overview with which to begin discussion. Since the newscasts furnish a visual sense of the times, they probably should be shown before students are asked to engage in more abstract activity, like reading or discussion. Then, hopefully, this verbal material will be grounded in some concrete perceptions of what was happening at that time.

In fact, without adequate exposure to visuals characteristic of the period, students may have difficulty forming accurate impressions of what the Middle Ages were like. This problem may be especially severe for poor readers, who have trouble understanding the text. It was interesting that a reasonably large percentage of students agreed with the survey item "The program provided some special perspectives on the time period because it portrays the era differently than the impression given in the textbook" (.55). One has to wonder what some of these pupils imagined about the medieval era before they viewed the show.

The need for visual material in history units is underscored by the strong student support (1.22) for the survey item "I prefer seeing 'Newscast From the Past' to reading about the same events in a book." The television programs communicate the events of the Middle Ages in a more dynamic way than a textbook can ever hope to. It was felt that the interest generated by the "Newscast" shows might stimulate further reading on medieval topics. However, only some students indicated that "I would like to read more about some of the events reported on the show" (.21).

Conceptual Learning From the "Newscast" Series

In addition to relating interesting facts and providing a feeling for the times, a really dynamic television program about history will deal with important concepts. Items were included in the survey to explore how students perceived their own conceptualizing about history as they watched the newscasts. While these responses are not actual measures of learning, studies have shown that perceptions about how worthwhile a program has been do correlate postively with actual later achievement gains.[15]

There was general agreement (.95) that "The program provided some special perspectives on how dramatically the world has changed since the Middle Ages." The series seems to effectively portray how the social, economic, and political circumstances of the medieval period differed from the present situation.

Some students also felt that "The program provided some special perspectives on how some aspects of life on this planet never change" (.41). There are attempts within "Newscast" episodes implying that certain historical themes persist through the ages. For example, the sixteenth century newscast describes a jungle war in Vietnam and the seventeenth century program reports on the violence in Northern Ireland between Protestants and Catholics.

There was also some support (.48) for the statement "The program suggested some lessons that history has to offer," despite the fact that these surveys were filled out by groups that had not discussed the program. With appropriate teacher follow-up, the responses to this item would probably be even more positive.

Admittedly these questions only superficially explore the issue of how conceptually stimulating the "Newscast" series may be. More specific examination of what pupils are really learning from the series would serve as a worthwhile research endeavor especially given the paucity of data presently available to history teachers on the instructional effectiveness of history drama. Nevertheless, these positive survey responses on crucial pedagogical issues remains encouraging.

However, not so encouraging was the negative pupil reaction (-.33) to the statement, "The newscast included some people whom I admire (and hope to fashion myself after)." Apparently, the heroes of the Middle Ages are truly difficult for modern day adolescents to identify with. Perhaps they are not portrayed in an attractive enough light. For whatever the reason, "Newscast" failed to inspire its audience in this regard.

But in another important respect, "Newscast" succeeded rather admirably. It was designed to present the major events happening simultaneously all over the world, a kind of horizontal slice of history. There is a need for this approach in most world history curricula, which proceed chronologically for lengthy periods within a given region and later double back to cover the same time frame in another part of the world. Therefore, it is difficult for a student to sense what was actually occuring at the same time in medieval Europe, Kublai Khan's China, the Indian empires of Latin America, the kingdoms of western Africa, the Islamic world, and so on. "Newscast" could fulfill this vital function in world history classrooms, and, in fact, students agreed that "The program provided some special perspectives on what was simultaneously happening all over the world during a given period of history" (.70).

This global perspective is an especially valuable aspect of the "Newscast" series. It indicates the increasing degree of contact which developed between different civilizations, over the centuries, elucidating the effects which cultures on different continents may have had upon one another. "Newscast" can contribute to a greater understanding of historically significant global trends, such as the spread of major religions, the rise of European imperialism, the development of multi-national business enterprises, the first stirrings of democracy as an internationally significant political movement, the evolution of well established global trading patterns, etc. The series can help establish the larger overall picture, and then the teacher and the text can proceed to fill in the details.

"Newscast From the Past" was greeted with considerable enthusiasm in the history classrooms I surveyed. Its use of a television news format helps bring history to life in ways the lecture or text cannot. It conveys a number of significant historical concepts, and provides a truly global perspective on the major trends in a given century. The "Newscast From the Past" series should be an exciting addition to world history classrooms across the nation.

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Using Television to Develop "The High School of the Future"

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The transformation of our schools into institutions more responsive to the needs of today's youth is an urgent challenge, fraught with innumerable difficulties. Such a formidable task requires resourceful approaches and ingenious solutions. One such project, "The Coalition for the High School of the Future" in northeast Ohio, decided to produce a low budget videotape to generate interest in its proposals for educational reform. This television show eventually proved highly successful in communicating the purpose of the project in dynamic fashion. This article will discuss how a considerable degree of interest in the coalition was aroused by this video, and will include the results of a survey that later documented specific ways in which the video helped establish a momentum that has propelled the High School of the Future project into its second year.

This coalition consists of five high schools and four universities in the Cleveland-Akron area. It also eventually hopes to include local community groups and businesses. The project hopes to revitalize the learning experiences offered at these five high schools. These "model" sites differ considerably from one another. They include a nearly all black inner city school, a virtually all white rural school, an affluent white suburban school, an urban "magnet" school, and a school with a racial mix that includes whites, blacks, and Hispanics.

Like other school reform projects of its kind that have arisen throughout the country in the past few years, this coalition has sought to facilitate change by encouraging school staff members to initiate their own plans for improving educational standards (McCormack-Larkin, 1985; Miller, Cohen, & Sayre, 1985). Each school established faculty committees to re-examine its educational priorities. A formal proposal for improving the instructional climate within the building would be drawn up, with the emphasis placed upon the developing of more effective methods of preparing young people for living in our rapidly changing society.

While each school would be encouraged to develop appropriate strategies for its own unique circumstances, the coalition leaders offered some suggestions for reform based upon recent research on the state of the American public high school (Boyer, 1983; Goodlad, 1984; Sizer, 1984). Curriculum revision whould be initiated by the teachers themselves. An emphasis upon communications skills would be strongly advised. An expanded teacher contract plan might be considered, to improve salaries and to engage teachers in professional activities through the summer. Team teaching efforts would be encouraged, to reduce some of the isolation of the job and to stimulate an exchange of ideas. Career ladders would be considered, so teachers could advance professionally to positions of instructional leadership.

Administrators would become active facilitators of positive change, rather than guardians of the status quo. Finally, dynamic new technologies for developing instruction would be acquired and effectively employed. In the spring of 1984, the coalition's leadership deliberated as to how they could most effectively present these recommendations to prospective participants. The possibility of producing a "video proposal" arose, and it seemed a dynamic way to communicate ideas, to publicize the project, and to motivate participants.

The Advantage of a "Video Proposal"

The objectives of the High School of the Future Project were both ambitious and ambiguous. The project needed an identity, in a sense, and a carefully conceived video could help give it one. The television medium can deliver material in very realistic and meaningful ways (Comstock, 1980). Its visual component adds a communication dimension that transcends what a public speaker can convey. In identifying problems to be redressed, actual examples can be shown. In recommending solutions, the possibilities can be staged and taped. Participating personnel can appear in the context of their own institutions so the viewer actually sees who is involved and where this project will be conducted. A tape can provide a "visual survey" of the project, so interested parties can judge its potential merits for themselves.

The coalition wanted to involve as many people as possible, who were associated with each of the five sites.

Its leadership felt strongly that high schools could only be improved if all concerned parties worked together for change (Hall et al., 1984; Pincus & Williams, 1979). This team would include teachers, administrators, students, university professors, parents, and members of the communities surrounding each high school. To attract the support they needed, project leaders felt a videotape would be ideal. Television can be a powerfully motivating medium (Frank & Greenberg, 1980; Pearl, 1982). Sequences can be carefully planned to portray the project in an extremely positive light. Music can subtly manipulate the emotions. A charismatic sounding narrator can be quite convincing. Because the success of the project depended so heavily upon establishing a broad base of support in its early stages, it was felt a persuasive videotape should be produced, despite the time and expense that might be involved.

Some practical considerations also led the coalition's leadership to commission the tape. In the effort to enlist support for the project, many meetings would be held. A media production is ideal for multiple presentations. A videotape would save project spokesmen from having to repeatedly explain their goals at meeting after meeting. It would also "standardize" the presentation so that all groups received the same information about the project, preventing possible misconceptions and miscommunication later on. In addition, the program would serve as a focal point for discussion between interested parties about the project providing a "common ground" around which issues could be debated and deliberated.

The geographically dispersed nature of the project sites presented another problem for the coalition. The five schools were scattered across an area of Ohio ranging from the ghettos of Cleveland to the rolling farmland east of Akron, a distance of approximately fifty miles. Travel time between sites could become both time consuming and expensive. Once again, distribution of tapes could eliminate some of this difficulty.

This particular collection of five high schools was in many ways a microcosm of the nation's schools as a whole. If these particular schools could successfully evolve into model "High Schools of the Future" the applicability of their cumulative experiences would be considerable indeed. However, if it ever hoped to become a viable, cohesive entity that drew strength from its diversity, the coalition would need to involve the various sites with one another. Up to this point, these five schools had very little contact with one another. A videotape seemed ideal for showing audiences throughout the project what each of the sites was like. It could help begin the process of establishing a network between schools by, in a sense, visually introducing them to one another.

The videotape also had the potential to introduce key participants. Interview footage with school principals and highly respected teachers might influence faculty members at each school. There is considerable evidence to indicate that the support of opinion leaders is critical to the success of an institutional change project (Rogers, 1983). In this case, key figures would be identified and then asked to voice their enthusiasm for the project on tape. Their most appropriate remarks would then be edited into the program at various points throughout the show. In this way, perhaps the tape could, to some degree, shortcircuit the lengthy interpersonal persuasion process generally involved in the adoption of innovative ideas (Mancuso, 1969). As it turned out, the videotape production team was fortunate enough to obtain interview footage with John Goodlad, a nationally recognized leader in the high school reform movement. Goodlad's presence on the tape lent the whole project some valuable credibility.

In the spring of 1984, it appeared a "video proposal" might serve as an effective means of clarifying project goals and generating some initial enthusiasm. Consequently, a team of faculty members and graduate students in the educational technology department of Kent State University's College of Education proceeded to produce the program. Production went on for several months, with the vast majority of costs consisting of in-house expenses. Kent State University possessed all the equipment necessary to produce the tape. The faculty members involved were already on salary and the

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students worked on the tape as part of their assistantships. By July of 1984, a seventeen minute program entitled "The High School of the Future" was ready for viewing and was shown to potential funding agencies. That September, it was disseminated to all five schools, where it was shown on repeated occasionsm including teacher meetings, parent meetings, student assemblies, and workshops. How successful was this program in achieving its objectives?

Survey Findings: How Successful was the Tape?

A survey was distributed to each of the five schools in the coalition. It was completed by the members of each school's leadership team, a group of teachers selected by their fellow faculty members to write a proposal for changing aspects of their school. The fifty-seven responses indicated some definite opinions about the impact of the television program on the project in its early stages.

"High School of the Future" Video Survey Results

+2 = strongly agree
+1 = agree
0 = neutral
-1 = disagree
-2 = strongly disagree

Rating	Survey Item
1.26	The videotape has helped make people aware of the project, who otherwise would not know of its existence.
.93	The tape effectively informs people about the nature of the project.
.57	I feel the tape helps clarify certain aspects of the project's "mission" which might otherwise have remained ambiguous or misunderstood.
1.25	The show conveyed the impression that improving our high schools is an important undertaking.

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1.23 The show portrayed the High School of the Future project in a very positive light.

-1.12 An audiotape of the narration would have been almost as effective as the videotape in conveying information about the project.

1.24 Visuals made the narrative material more interesting.

.78 Comments on tape by project participants were especially convincing because they should understand the situation at their own schools.

.93 These remarks by involved staff helped establish the impression that some changes in public high schools are necessary.

.96 The interview footage with staff from each school helped convey a sense of commitment on the part of all five schools.

.93 The tape made me feel my school is part of something larger, which extends across this part of the state.

The scenes of the U.S. space program suggested:
1.30 the future
1.20 technology
1.12 achievement
.80 the frontier
.54 patriotism

What do these survey results indicate about the power of video to publicize? It turned out that there was, in fact, considerable agreement with the statement that "The videotape has helped make people aware of the project, who otherwise would not know of its existence" (rating of 1.26). On open-ended parts of the survey, project participants were free to elaborate, and the following statements were recorded.

"The tape was used effectively in workshops to introduce the public to the project."

"At the first workshop where the tape was shown, a high degree of interest was sparked and continues now."

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> "We have had positive involvement from representatives of several groups, after they reviewed the tape."

Thus, there was strong evidence that a primary objectives of the tape was accomplished; to expand awareness about the project in hopes of involving large numbers of participants in the coalition.

Did the medium of television provide a clear statement of goals that effectively articulated its purposes? It appears to have been generally successful in this regard also. A average score of .93 was recorded for the statement, "The tape effectively informs people about the nature of the project." A .57 was received in response to the item, "I feel the tape helps clarify certain aspects of the project's mission which might otherwise have remained ambigious or misunderstood." A lower score on this last item was not surprising. The goals of the project were deliberately stated in general terms, so that individual schools could interpret them as they saw fit. Several anecdotal responses indicated that the program provided teachers with a cogent summary of what the project hoped to accomplish and even implied that the show may have served to solidify the coalition.

> "It shows the whole program...its was crisp, clear, and to the point."
>
> "The coalition concept was conveyed well."
>
> "The scope of the project seemed so vast to me. I needed a 'cohesive device' (the tape) to bring my

fragmented ideas and expectations together."

Did the videotape effectively argue the necessity for change, in its efforts to motivate participants? The statement "The show conveyed the impression that improving our high schools is an important undertaking" received considerable support (1.25 rating). Convincing participants that this particular project could be a viable approach to improving the system was also critical. The item "The show portrayed the High School for the Future project in a very positive light" was rated at 1.23. The video was clearly successful in portraying the project as a meaningful one, with good intentions. Some survey comments on this issue were:

> "The tape effectively conveyed the desperate need for change."
>
> "It had appeal for all who are concerned with the future of education."

Thus, survey responses supported the informal feedback initially received that "The High School of the Future" tape successfully contributed to publicizing the project, communicating its basic goals, and building support for it. But how was it able to do so? What specific capabilities of video contributed to this success? What production approaches were used to accomplish the tape's objectives? How can educators interested in developing similar tapes for their own projects achieve similar results?

Effectively Presenting Innovative Ideas Through Video

Many items on the survey dealt with production issues. One strength of the television medium is, of course, its ability to present dynamic visuals. The strength of a video presentation at meetings, in comparison with a public address, lies primarily in its ability to provide this visual material. To test the significance of this visual component, several relevant questions were included in the survey. One hypothesized, "An audiotape of the narration would have been almost as effective as the videotape in conveying information about the project." This statement was strongly disagreed with (-1.12). The item "The visuals made the narrative material more interesting" was, on the other hand, strongly agreed with (1.24). Viewers also agreed with the statement "The visuals included in the program enhanced the show by providing specific instances of what the narrator was discussing" (.95). Apparently, the visual aspects of the show were absolutely critical to its success. These results help explain the enthusiasm expressed by coalition leaders over the tape's effectiveness as an opener at meetings about the project. Several written comments alluded to the significance of the role played by visuals in communicating to coalition members what the project was all about:

"A good visual overview of the project."

"It showed the diversity of schools involved."

"It is easier to convey the general aims of the project through visuals."

As mentioned, there was a considerable amount of interview footage included in "The High School of the Future." Coalition leaders, including both administrators and teachers, expressed their aspirations for the project. Editing allowed the producer to select the most articulately expressed comments and to insert them into the show at appropriate moments. The result was often a meaningful "testimonial" for the project, which gave an impression of commitment, unity, purposefulness, and optimism.

The questionnaire sought to verify whether, in fact, the intended image came across. General agreement was recorded in reaction to the following statements: "The comments on tape by project participants were especially convincing because they should understand the situations at their own schools" (.78), "These remarks by involved staff helped establish the impression that some changes in public high schools are necessary" (.93), "The interview footage with staff from each school helped convey a sense of commitment on the part of all five schools" (.96), and "The tape made me feel my school is part of something larger, which extends all across this part of the state" (.93).

It appears that videotape can effectively present the support of key opinion leaders, something that has been considered critical to the success of any institutional change project. Normally, these kinds of endorsements would be delivered around the school building over a period of weeks, or even months. Videotape streamlines this process, so that large groups can be immediately exposed to these statements of support. This video approach may thereby help accelerate the change process.

Possibly the most interesting finding on the entire survey was that viewers were definitely affected by a "visual metaphor" included in the show. To suggest the future, a one minute introductory segment was prepared, using NASA footage, in which the viewer "travelled" to the moon and back, then witnessed the launching of the space shuttle. The idea was to immediately remind the viewer that technology is advancing rapidly and that the future is filled with potential changes of enormous magnitude. These technological triumphs also exemplified the kind of achievement that upcoming generations of students will hopefully aspire to.

It was hoped that audiences would be encouraged by such footage, to consider where their high schools were heading and how they would need to adapt to the rapid transformation of our society. Survey responses did, in fact, indicate that the space metaphor was very effective. Teachers responded that "`The scenes of the U.S. space program suggested the future" (1.30), "technology" (1.20), and "achievement" (1.12). These shots also suggested to a lesser degree, "the frontier" (.80) and "patriotism" (.54). When asked to elaborate on this issue, the following reactions were recorded:

> "The tape makes you realize the future comes quickly."
> "Schools are heading for frontiers unknown."
> "Students must be prepared to meet the future."

"New horizons to explore and new challenges to meet."

"The future is now... it inspires me."

I hope that responses like these, along with the data reported, have convinced many readers that a television program can contribute significantly to the successful initiation of an institutional change project. Today, television is becoming an increasingly cost-effective medium. Video technology is advancing at a remarkable rate. Television portapaks are becoming lighter, easier-to-operate, less expensive, and of higher quality. Obtaining respectable looking, worthwhile footage has become economically feasible for groups which previously found the cost prohibitive. Furthermore, an inexpensive editor, like Panasonic's R-500 (@ $100.00), can be connected between two half-inch recording units, so a program can easily be assembled from raw footage.

A respectable television program can be produced quite parsimoniously these days, especially if there is a person on your staff who is skilled in television production. Once developed, a video has large potential audiences, especially given the rapid proliferation of videocassette recorders in both institutions and homes. We are in the midst of a "video revolution" and those interested in promoting a special project should consider taking advantage of this dynamic medium.

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Teachers' guides and general information about the "Newscast From the Past" series can be obtained from:

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TITLE: Old Wine in New Bottles: Subliminal Messages in Instructional Media

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> Platters laden with fried chicken and potatoes, spaghetti smothered in tomato sauce, cream cupcakes and chocolate bars spin slowly round on the screen. Oddly enough, these treats aren't displayed to tempt you. They appear as reminders of foods you should avoid eating.
>
> "Watch now, and start to say good-bye to the wrong kinds of foods," says the silky-voiced female narrator. "With daily viewing, you will watch your desire for fattening foods simply disappear."

This scene was from the twenty-two minute videotape, "Weight Loss Programming," by Hypnovision, that was designed to help viewers lose weight through daily viewing. Besides providing basic information on diet and exercise, the video used visual and aural subliminals. The visual messages were flashed on the screen for one-thirtieth of a second at regular intervals and the audio messages were compressed, mixed with music and transmitted just below the threshold of normal hearing.

Subliminal perception (or stimulation) describes any word, image or sound that is not perceived within the "normal" range of consciousness, but makes an impression on the mind. This involves words or pictures that are flashed so quickly that the eye cannot transmit them to the conscious brain, or words at such a volume that they evoke no conscious memory.

This past year a variety of products have appeared on the market that have the mystique of subliminals and promise improvement in a variety of areas. Audio tapes, with the subliminal messages transmitted below the threshold of audible sound, offer to transform the listener's life. Stimutech, Inc. has a device that interfaces a computer with a television allowing the viewer to receive subliminal messages while watching TV. Greentree Publishers offer a computer program that allows the computer operator to write one's own subliminal messages. These messages are flashed regularly as the programmer continues on with other computing tasks. Several videotape companies produce videotapes like the one described above. Most of these tapes encourage replacement of bad habits with healthier ones. The ads for these products emphasize that the subliminal programs will help bring about dramatic results with minimal effort. This presents an attractive proposition to the consumer. However, whether they do what they claim is open to debate. Many mental health professionals and psychologists do not agree as to whether subliminal communication is effective in changing human behavior and attitudes. Second, these subliminal products have been introduced to the market, yet they have not been clinically tested. Silverman, formost investigator in the use of subliminal stimulation to direct manipulation of behavior, believes that companies that sell subliminal products designed to affect bahavior should set up a research unit that tests their products (Levy, 1984). Currently, there is no documentation of any testing of these products to determine the effectiveness of their subliminal messages.

Purpose of Study

The purpose of this research was to conduct a study to determine if viewing a commercially prepared videotape containing written and aural subliminal messages was more effective at producing weight loss than a videotape containing the same content but with no subliminals.

"Weight Loss Video Programming," by Hypnovision, the videotape selected for this study, endorsed no particular diet or exercise plan, and made no requirements of the viewers other than the willingness to change diet and exercise habits and to watch the videotape daily for thirty days. It was felt that, while weight loss was not a traditional focus of educational research, the availability of this particualr videotape would give insights into the effectiveness of subliminal messages that might have a direct relationship to traditional educational needs. Subjects were measured to see if changes occurred in these areas:

1) BEHAVIOR

Food Intake Recall (FIR)--measured by one day food recall at the end of the testing period. This analyzed the subjects' food intake for nutrients and calories. The FIR was used to compare the amount of intake of high calorie, low nutritional foods.

Weight and Skinfold Test (WST)-- measured at the beginning and end of the testing period. Skinfold tests reveal and approximate percentage of body fat. All skinfold tests were performed by the same physical education instructor who was experienced in administering skinfold tests. To increase accuracy. three measurements were taken at each skinfold testing and these scores were averaged. Subjects were also weighed at the beginning and end of the experiment on the same scale, by the same person.

2) ATTITUDE

Food and Exercise Attitude Test (FEAT)--administered at the beginning and end of the testing period to measure the effectiveness of the subliminal messages on the tape: "EAT LESS", "GET ACTIVE", "CALM", EAT SLOW", "YOU CAN DO IT". The attitude test items were chosen from existing food attitude test items that were relevant to the subliminal messages and that fell into the following categories: eating for internal reasons, eating for external reasons, oral control, basic diet and exercise behavior. The subjects responded to the twenty FEAT questions on a five-point Likert scale ($r = 0.72$).

Treatment groups

1) The experimental group consisted of viewers who watched the twenty-two minute Weight Loss videotape with subliminal messages. This group was composed of those subjects randomly selected and placed in the yellow and orange groups.

2) The control group consisted of viewers who watched the twenty-two minute Weight Loss videotape without subliminal messages. This group was composed of those subjects randomly selected and placed in the blue and green groups.

Hypotheses:

The general hypothesis was that subjects receiving subliminal stimuli in a postive, emotionally arousing way would be able to stop a related and undesirable type of behavior (by mirroring) with greater success than subjects not receiving those messages.

1) Subjects viewing the videotape with the subliminals will show a greater weight loss than those viewing the videotape without subliminals.

2) Subjects viewing the videotape with the subliminals will show a greater loss in percentage fat than those viewing the videotape without subliminals.

3) Subjects viewing the videotape with the subliminals will show a better attitude toward eating healthier foods and exercising than those viewing the videotape without subliminals.

4) Subjects viewing the videotape with the subliminals will record fewer instances of high calorie, low nutritional food intake than those viewing the videotape without subliminals.

5) Subjects viewing the videotape with the subliminals will be able to maintain the weight loss for a longer period of time than those subjects viewing the videotape without subliminals.

Experimental Design:

Campbell and Stanley's (1963) experimental design number four, the Randomized Pretest-Posttest Control Group Design, was used in this study. Students were randomly selected for treatment groups, a pretest was given and preliminary measurements were taken. After the treatments were administered, a posttest was given and final measurements were taken. The import of the treatments was determined by subtracting subjects' pretest scores from posttest scores. The appropriate test for significance at the .05 level was then applied to ascertain if the difference was greater than what might occur due to chance. For this experiment, this design was considered superior to others (Campbell and Stanley, 1963).

Dependent Variables:

1) Measure of subject's attitude toward food and exercise (FEAT).

2) Measurement of subject's behavior toward food and exercise by change in weight and percentage of body fat.

3) Measure of subject's behavior toward food and exercise by incidence of high calorie-low nutritional food intake (FIR).

Independent Variable:

1) Videotape viewed by subjects:
   A. Videotape on weight loss containing subliminals.
   B. Videotape on weight loss not containing subliminals.

Subjects:

Subjects participating in this study were undergraduate and graduate students, and staff from Iowa State University who responded to advertisements in the campus newspaper or to flyers posted in buildings on the campus during Spring Semester, 1985. Those interested attended one of three orientation sessions. The orientation sessions were conducted to explain the study, to explain the participants' responsibilities and to answer questions.

Subjects' responsibilities were: 1) to get a signed medical clearance, 2) to take the FEAT pretest, be weighed, and be given the skinfold test, 3) to view an assigned videotape twenty-five times within a thirty-seven day period, 4) to return and be reweighed, be given the skinfold test, and take the FIR and FEAT posttest. If subjects met those requirements they were paid twenty dollars. Medical clearances were obtained at the campus health service at no cost to the participants. Fifty-nine subjects started the study and fifty-one fulfilled all the requirements.

The Videotape:

The videotapes used in this study, "Video Weight Loss Programming", were developed in 1983 by John Koenig of Hypnovision. Two videotapes were used: one with visual and audio subliminals (the commercially available version), and one without subliminals. Each videotape was twenty-two minutes long and the perceptible content of each videotape was the same. In order to accomodate the fifty-nine subjects viewing the tape daily, Hypnovision provided eight copies of each version. To equalize videotape wear and hinder subjects' knowledge of the type of tape they were assigned to, each subject was issued a color-coded card. Those with blue and green cards were control subjects. They watched the videotape without the subliminals. The yellow and orange groups (experimental subjects) watched the videotape with the subliminals. Tapes were viewed at the university library.

The content of the videotapes was basic, accepted information on diet, exercise and weight control. The videotape opened with scenes of running water while the narrator urged relaxation. Plates of donuts, candy bars and fried chicken revolved on the screen, and the viewer was told to resist these foods by saying, "No Thank You." During the course of the videotape viewers were told to eat slowly, take small bites and chew thoroughly. They were instructed to drink up to eight glasses of water and exercise daily. Several types of exercises were demonstrated as the subliminal audio message, "YOU CAN LOSE WEIGHT NOW" was repeated 200 times during the music sequence. The visual subliminals were one frame edits that were flashed every five to ten seconds at a speed of one-thirtieth of a second. This was below most people's ability to perceive them. These messages were "EAT LESS", "GET ACTIVE", "CALM", "EAT SLOW", and "YOU CAN DO IT". Both videotapes stated that they contained subliminal messages and the messages were printed on the screen during the introduction. Both videotapes began with scenes of flowing water and viewers were told to relax. As the name of the company implied, the videotape attempted to put the viewer in a relaxed state so that the information and the subliminals presented would have more of an effect.

Review of the Literature:

The idea of whether individuals can be affected by their environment without conscious awareness has fascinated many for more than two thousand years. Spence (1961) described the mechanism by which unconscious stimuli can affect behavior. According to Spence, memory traces are organized in the unconscious into semipermanent aggregates called schemata. A schema is an organization of ideas, memories, and concepts that are linked through association. Subliminal activation of a schema occurs when a word or image enters the unconscious and becomes attached through association to the general schema. Because of the emotional content of the stimulus and because memories and ideas already comprising the schema are meaningfully related, the subliminal stimulus activates the entire schema.

Signal-detection theory (Swets, Tanner and Birdsall, 1961; Tanner and Swets, 1954) has explained how unconscious stimuli can be processed without conscious awareness. Signal detection theory assumes all signals impinging on an organism contribute to a continuum of sensory activity and experience. All signals increase the probability of raising the excitation level to a point where the organism will report the signal's presence. The organism makes decisions regarding attending and responding on the basis of decision rules, that are based on the comparison of incoming signals relative to the needs of the organism. Since all signals are processed, all information exists within the organism. Certain information is attended to and consciously experienced while the rest does not gain conscious recognition. Hence, some experiences are filtered out before they reach consciousness because they are not recognized as signals, yet they are still processed.

While the controversy over subliminal perception has continued on theoretical and empirical grounds, there has also been public response to the subliminal effect. In 1957, this controversial phenomenon came to the public's attention when patrons in a movie theater in New Jersey were subjected to "HUNGRY? EAT POPCORN", and "DRINK COCA-COLA" messages flashed on the screen every five seconds throughout a film. General sales figures over a six-week period, compared with previous sales, increased 57.5%, and Coca-Cola sales by 18.1% (Brooks, 1958). Use of this technique drew immediate negative responses from the public. People did not want their subconscious minds influenced.

The foremost investigator in subliminal stimulation in psychology has been Lloyd Silverman (1976). Silverman's study of psychoanalytic dynamic activation relationships involved the tachistoscopic presentation of wish-related verbal and pictorial stimuli for provoking unconscious wishes subliminally. Psychoanalysts have posited that different symptoms of abnormal behavior are related to different unconscious conflicts and that symptoms can be viewed as symbolically expressing aspects of the particular underlying conflict.

Several studies have suggested that both situational and individual differences are related to the strength of subliminal effects. Fisher and Paul (1959), and Fiss (1966), found that when subjects were in a state of relaxed passivity, subliminal effects were maximized. Dixon (1971) suggested that subliminal effects were more likely to be found when subjects were in a low state of arousal. In this case, attention was unselective and cognitions were intuitive, global and unbound by logical constraints. On the other hand, high levels of arousal tended to diminish subliminal effects.

Subliminal stimulation has been explored in the area of learning and education. Five general areas where subliminal perception might be applicable to education were in the areas of problem solving, cognitive learning, motivation, elaborative thinking and perception (DeChenne, 1981-82).

Zuckerman (1960) had subjects produce stories after viewing the subliminal messages "WRITE MORE" or "DON'T WRITE". Their ability to produce stories mirrored the message they received subliminally. When presented with supraliminal messages that were easily recognizable, "WRITE MORE" and "DON'T WRITE", the performance of subjects at producing stories were not affected by the messages they received. Zuckerman felt this was an example how a subliminal stimulus could by-pass processes of conscious intent and revealed that it might be impossible to resist the instruction of imperative subliminal messages that were not consciously experienced.

Smith, Spence and Klein (1959) tested to see if word meaning alone had a subliminal influence on conscious thought. When the words "ANGRY" and "HAPPY" were exposed subliminally and were immediately followed by a clear supraliminal figure (a blank, expressionless face), the subliminal words influenced impressions of the latter. Descriptions of the face were pleasant in "HAPPY" pairings and unpleasant in "ANGRY" pairings.

Parker (1982) found that subjects who were normal college students who received subliminal stimulation "MOMMY AND I ARE ONE" and "MY PROF AND I ARE ONE", in conjunction with teaching and counseling, received significantly higher grades than similar students who received the control stimulation "PEOPLE ARE WALKING". Parker agreed with Silverman that subliminal stimulation had an adaptive enhancing effect on behavior.

Experiments in education that did not reveal dramatic positive results of subliminal stimulation included studies by Severance and Dyer (1973) and Grant, Blohm and Ledford (1981). Severance and Dyer found that the presence of a subliminal color interfering word did not affect color naming. They further questioned if subliminal effects were restricted to those that produced emotionally laden responses, since words like red, blue and green were neutral and lacked emotional meaning.

Grant, Blohm and Ledford (1981) investigated the effects of subliminal stimuli on the development and improvement of execution of racquetball ceiling shots, and increased racquetball participation. Results showed that females could possibly be affected by visual subliminal stimulation to a greater degree than males, and questioned if filming subjects' performances and presenting it to them subliminally would better arouse them and lead to improved learning of this psychomotor skill.

These studies reveal two types of effects that can be produced by subliminal stimuli: the mirroring effect and the effect of arousal and learning from emotionally laden stimuli. These are related to habit breaking and habit forming behavior.

Attitudes are seen as enduring predispositions that are not innate but are learned. Thus, even though attitudes are not momentarily transient, they are susceptible to change (Zimbardo, Ebbesen, and Maslach, 1977). In 1931, Thurstone demonstrated the impact of film on attitudes. By using two films, one depicting the Chinese favorably and the other unfavorably, Thurstone found it was possible to produce either positive or negative changes in attitude toward Chinese people (Thurstone, 1931).

Though media are mere carriers of information and do not directly influence learning under any condition (Clark, 1983), there are approaches and techniques using media that seem to maximize desirable attitudinal outcomes. Simonson, at Iowa State University, has been investigating the topic of instructional media and attitude change for the past several years (1979, 1980, 1981). He outlined six guidelines that can promote certain attitudinal outcomes in learners. The guideline most relevant to this study was guideline six that stated: Learners who experience a purposeful emotional involvement or arousal during instruction are likely to have their attitudes changed in the direction advocated as the purpose of the mediated message.

It has often been reported that an efficient method for changing behavior would be to change one or two underlying general dispositions or attitudes. Festinger's (1957) theory of cognitive dissonance is based on the idea that human beings demonstrate a great desire for consistency and congruity in their attitudes and behaviors and, conversely, find conflict between what they know and what they do disturbing and discomfiting (Zimbardo, Ebbesen, and Maslach, 1977).

Festinger (1964) suggested that, when opinions or attitudes are changed through the impact of persuasive communication, this change is unstable and will disappear unless an environmental or behavioral change can be brought about to support and maintain it. The data show that the occurrence of behavior change does not depend upon the prior occurrence of an attitude change, or vice versa. Greenwald (1966) contended there was no automatic relationship between attitude and behavior; rather, they may be independently determined by the environment. Normally, the environment will produce in persons parallel effects on belief and behavior, so these concepts will appear to be correlated. In special situations, such as persuasion following an opposing commitment, the environment exerts differential pressures on belief and behavior and then they appear to be uncorrelated (Greenwald, 1966).

Summary:

Subliminal stimulation is a phenomenon that has been shown in some instances to influence basic drives, though the strength of these effects seem to be related to situational and individual differences. Subliminal effects are maximized when subjects are in a state of relaxed passivity. High levels of arousal tended to diminish subliminal effects. Subliminal stimulation might influence learning, and two effects produced by subliminal stimuli were the mirroring effect and the effect of arousal and learning from emotionally laden stimuli.

Media can be used to change attitudes. Learners who experience a purposeful emotional involvement or arousal are likely to have their attitudes changed in the direction of the mediated message. Change in attitudes does not necessarily mean a change in behavior.

Results:

Hypothesis 1: Subjects viewing the videotape with the subliminals will show a greater weight loss than those viewing the videotape without subliminals.

The descriptive statistics shown in Table 1 indicated that the subjects assinged to the weight loss videotape with subliminals weighed less initially (x = 139.47 lbs.) than those assigned to the weight loss videotape without subliminals (x = 141.53 lbs.). After weighing at the end of the treatment, a change in weight was obtained by subtracting initial weight from weight after treatment. The data in Table 1 indicated that the viewers of the videotape with the subliminals lost an average of 1.84 pounds compared to the control group which lost an average of 2.66 pounds. Hypothesis 1 was not accepted.

Hypothesis 2: Subjects viewing the videotape with the subliminals will show a greater loss in percentage body fat than those viewing the videotape without subliminals.

The descriptive statistics shown in Table 2 indicated that the subjects assigned to the weight loss videotape with subliminals had a greater percentage of body fat initially, though they weighed less (Table 1) than subjects assigned the weight loss videotape without the subliminals. After skinfold measurements were taken at the end of the treatment, the change in percentage of body fat was obtained by subtracting initial percentage body fat from perentage body fat after treatment. Table 2 indicated that the viewers of the videotape with the subliminals lost an average of .41 percent body fat compared to the control group which lost an average of .53 percent body fat. Hypothesis 2 was not accepted.

Hypothesis 3: Subjects viewing the videotape with subliminals will show a better attitude toward eating healthier foods and exercising than those viewing the videotape without subliminals.

The descriptive statistics shown in Table 3 indicated that the subjects randomly assigned to the weight loss videotape with subliminals scored lower initially on the FEAT pretest than those assigned to the weight loss videotape without subliminals. After administering the FEAT posttest, the change of attitude was obtained by subtracting pretest scores from posttest scores. The data reported in Table 3 indicated that the viewers of the videotape with the subliminals showed an improved attitude toward food and exercise of 11.18 points compared to to viewers of the videotape without the subliminals that showed an improved attitude toward food and exercise of 7.37 points. However, the difference between the two groups was not statistically significant, and hypothesis 3 was not accepted.

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Table 1. t-test: Viewers of weight loss videotape with subliminals vs viewers of weight loss videotape without subliminals in weight loss (H_1)

A. Descriptive statistics

	Weight		
	Before treatment	After treatment	Weight loss
Viewers of videotape with subliminals	x = 139.47 SD = 22.33 N = 27	x = 137.63 SD = 23.30 N = 27	x = 1.84 lb loss SD = 2.91 N = 27
Viewers of videotape without subliminals	x = 141.53 SD = 15.67 N = 24	x = 138.87 SD = 14.82 N = 24	x = 2.66 lb loss SD = 3.12 N = 24

B. t-test

Group	N	Mean	SD	t value	t prob
Viewers of videotape with subliminals	27	1.84 lb loss	2.91	.93	NS[a]
Viewers of videotape without subliminals	24	2.66 lb loss	3.12		

[a] NS = not statistically significant.

Table 2. t-test: Viewers of weight loss videotape with subliminals vs viewers of weight loss videotape without subliminals in loss of percent body fat (H_2)

A. Descriptive statistics

	Percent body fat		
	Before treatment	After treatment	Body fat loss
Viewers of videotape with subliminals	x = 30.50 SD = 6.05 N = 27	x = 30.09 SD = 6.02 N = 27	x = .41 loss SD = 1.92 N = 27
Viewers of videotape without subliminals	x = 28.10 SD = 6.76 N = 24	x = 27.57 SD = 7.09 N = 24	x = .53 SD = 2.29 N = 24

B. t-test

Group	N	Mean	SD	t value	t prob
Viewers of videotape with subliminals	27	.41 loss	1.92	.19	NS[a]
Viewers of videotape without subliminals	24	.53 loss	2.29		

Table 3. t-test: Viewers of weight loss videotape with subliminals vs viewers of weight loss videotape without subliminals in food and exercise attitude change (H_3)

A. Descriptive statistics

	Attitude[a]		
	FEAT pretest	FEAT posttest	Attitude change
Viewers of videotape with subliminals	x = 56.19 SD = 7.45 N = 27	x = 67.37 SD = 6.83 N = 27	x = 11.18 SD = 9.28 N = 27,
Viewers of videotape without subliminals	x = 62.46 SD = 7.55 N = 24	x = 69.83 SD = 7.81 N = 24	x = 7.37 SD = 7.56 N = 24

B. t-test

Group	N	Mean	SD	t value	t prob
Viewers of videotape with subliminals	27	11.18	9.29	1.44	NS[b]
Viewers of videotape without subliminals	24	7.37	9.56		

[a] Higher scores indicate a more positive attitude.

[b] NS = not statistically significant.

Hypothesis 4: Subjects viewing the videotape with the subliminals will record fewer incidents of high-calorie, low-nutritional food intake than those viewing the videotape without subliminals.

The descriptive statistics shown in Table 4 indicated that the subjects assigned to the weight loss videotape with subliminals reported an average intake of 3.15 servings of high-calorie, low-nutritional foods, during the 24-hour period of April 30 - May 1, after treatment, compared to the control group who reported an average of 2.21 servings. Hypothesis 4 was not accepted.

Hypothesis 5: Subjects viewing the videotape with the subliminals will be able to maintain the weight loss for a longer period of time than those subjects viewing the videotape without subliminals.

The descriptive statistics shown in Table 5 indicated that a random sample of eight subjects assigned to the weight loss videotape with subliminals reported a gain of .31 pounds 10 days after treatment (May 10, 1985) compared to a loss of .53 pounds from a random sample of nine subjects assigned to the weight loss videotape without subliminals. The change in weight was obtained by subtracting the weight after treatment on May 1, 1985 from weight on May 10, 1985. Hypothesis 5 was not accepted.

In order to attempt to determine why the hypotheses were not supported by the data, in post hoc research, a Pearson correlation was utilized. This was to determine if any relationships existed between the variables (Table 6). Statistically significant correlations were as follows:

1. Change in weight (difference in weight between initial weighing and weighing after treatment) was inversely correlated to change in attitude (difference in attitude toward food and exercise between pretest and posttest). Specifically, as weight change decreased, the change in attitude was more positive. This result was opposite of what was expected.

2. Change in weight (difference in weight between initial weighing and weighing after treatment) was correlated to FIR (Food Intake Recall). As weight change (loss) increased, the incidence of high-calorie, low-nutritional food intake increased. This result was opposite of what was expected.

3. Age was correlated to change in body fat (difference in percent body fat between initial measurements and measurements taken after treatment), as age increased, body fat percentage changed more.

The first two relationships were unexpected and difficult to explain. When a Pearson Correlation was performed only on the experimental group that viewed the videotape with the subliminals, the correlation between change in weight and change in attitude was not significant. Further examination is suggested. The third relationship of increase in age to increase of body fat was not too surprising. The majority of older subjects involved in sedentary jobs did not have as much available time to exercise as the college students. Also, older women tend to eat less rather than increase exercise for weight control.

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Table 4. t-test: Viewers of weight loss videotape with subliminals vs viewers of weight loss videotape without subliminals in Food Intake Recall of high-calorie, low nutritional servings of food (H_4)

A. Descriptive statistics

	Food Intake Recall after treatment[a]
Viewers of videotape with subliminals	x = 3.15 SD = 2.92 N = 27
Viewers of videotape without subliminals	x = 2.21 SD = 2.57 N = 24

B. t-test

Group	N	Mean	SD	t value	t prob
Viewers of videotape with subliminals	27	3.15	2.92	1.21	NS[b]
Viewers of videotape without subliminals	24	2.21	2.57		

[a] Higher numbers indicate a higher incidence of intake of high-calorie, low-nutritional foods.

[b] NS = not statistically significant.

Table 5. t-test: Viewers of weight loss videotape with subliminals selected at random vs viewers of weight loss videotape without subliminals selected at random in weight loss ten days after treatment (H_5)

A. Descriptive statistics

	Reweigh ten days after treatment
Viewers of videotape with subliminals	x = .31 lb gain SD = 1.77 N = 9
Viewers of videotape without subliminals	x = .53 lb loss SD = 1.09 N = 9

B. t-test

Group	N	Mean	SD	t value	t prob
Viewers of videotape with subliminals	8	.31 lb gain	1.77	.61	NS[a]
Viewers of videotape without subliminals	9	.53 lb loss	1.09		

[a] NS = not statistically significant.

Table 6. Pearson Correlation: Relationships among the variables

	Age	Change in weight[a]	Change in body fat[b]	Attitude change[c]	FIR[d]
Age		.0048 (51) p=.487	.2275 (51) p=.054	.1648 (51) p=.124	-.0961 (51) p=.251
Change in weight			.4956 (51) p=.000	-.3345 (51) p=.008	.3650 (51) p=.004
Change in body fat				-.1460 (51) p=.153	.0592 (51) p=.340
Attitude change					-.0016 (51) p=.496
FIR					

[a] Change in weight = difference in weight between initial weighing and weighing after treatment.

[b] Change in attitude = difference in attitude toward food and exercise between pre and post FEAT test.

[c] Change in body fat = difference in percent body fat between initial skinfold measurements and measurements taken after treatment.

[d] FIR (Food Intake Recall) = incidence of consumption of high-calorie, low-nutritional food.

After completion of treatments, subjects were given a questionnaire to complete. Questions were concerned with the effectiveness of the videotape that was viewed. Results were recorded in Table 7. The questions asked and a summary of responses are recorded below:

1. Do you believe you saw the tapes with the subliminals?

Ninety-three percent of subjects assigned to the videotape with subliminals believed they viewed the tapes with the subliminals, compared to twenty-one percent of the subjects assigned to the videotape without subliminals.

2. Do you feel the tapes are effective?

Seventy-four percent of subjects assigned to the videotape with subliminals felt the tapes were effective, compared to sixty-seven percent of the subjects assigned to the videotape without subliminals.

3. How did the tapes help?

Both groups reported the same top five responses; twenty-four percent in each group said that the tapes made them more aware of the foods they ate. Other responses indicated the tapes made them feel relaxed, helped them eat less, and motivated them to exercise more and to drink more water.

4. Would you like to continue watching the tapes?

Fifty-six percent of the subjects assigned to the videotape with subliminals respondend yes, compared to thirty-three percent of the subjects assigned to the videotape without subliminals.

5. Would you consider buying the tape if you have a VCR?

Forty-two percent of the subjects assigned to the videotape with subliminals said they would buy it, compared to thirty percent of the subjects assigned to the videotape without subliminals.

6. Other comments you might have about the experiment:

Both groups reported that the repetition of daily viewing became boring, but the videotape would be good to view before eating. All other comments are recorded in Table 7.

According to these responses, the viewers of both groups were generally aware if they were or were not receiving the subliminal messages. However, the viewers assigned to watch the videotape with subliminals were more favorable to the continuation of this type of weight loss program. The majority of both groups felt the videotapes were effective. When asked how the tapes helped, the most popular response for both groups viewing the videotapes was that it made them aware of what they ate. The importance of awareness was stressed throughout the content of the videotape.

Table 7. Responses from viewers of the "Video Weight Loss" tapes with and without subliminals upon completion of the treatment.

Viewers of videotape with subliminals		Viewers of videotape without subliminals	
Response	%	Response	%
1. Do you believe you saw the tapes with subliminals?			
Yes	93	Yes	21
No	4	No	71
Unsure	4	Unsure	8
2. Do you feel the tapes were effective?			
Yes	74	Yes	67
No	22	No	13
Unsure	4	Unsure	21
3. How did the tapes help?			
1. Made me aware of what I ate.	24	1. Made me aware of what I ate.	24
2. Motivated me to exercise more.	15	2. Relaxed me.	18
3. Helped me eat less.	15	3. Helped me eat less.	11
4. Relaxed me.	12	4. Motivated me to exercise more.	8
5. I drank more water.	10	5. I drank more water.	8
6. I ate slower.	10	6. I controlled fattening foods.	8
7. I controlled fattening foods.	7	7. Tape encourage me.	5
8. I took smaller bites.	2	8. I ate slower.	5
9. Tape encouraged me.	2	9. I took smaller bites.	3
10. I drank less alcohol.	2	10. Tapes gave reinforcement.	3
		11. I put food in perspective.	3
		12. Tapes offered suggestions.	3

Table 7. (Continued)

Viewers of videotape with subliminals		Viewers of videotape without subliminals	
Response	%	Response	%
4. Would you like to continue watching them?			
Yes	56	Yes	33
No	44	No	67
5. Would you consider buying the tape if you had a VCR?			
Yes	42	Yes	30
No	50	No	65
Unsure	8	Unsure	4
6. Other comments you might have about the experiment:			
"Worthwhile"		"Message good"	
"Helped my eating habits"		"Good program"	
"Made me sleepy and hungry"		"Would like to see before eating"	
"Would like to see before eating"		"Boring" (three comments)	
"Boring" (three comments)		"Positive"	
		"Bouncing exercises"	

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The remainder of the responses from both groups were quite similar. The viewers of the videotape with subliminals received the subliminal message "CALM", although viewers of both groups said the tape relaxed them. Another subliminal message was "EAT LESS", yet both groups said the tape helped them eat less (ranked third). The subliminal message "YOU CAN DO IT" was flashed visually, plus the audio message "YOU CAN LOSE WEIGHT NOW" was compressed and transmitted with music on the videotape with subliminals. There was one difference, however. The comment that the tapes encouraged them was mentioned more by the viewers of the videotape without subliminals than by the viewers of the videotape with subliminals. This might mean that the subliminal messages were too similar to the preceptable content and were repetitious of that content, so that possibly the subliminal messages were rendered ineffective.

One can only speculate as to why no statistically significant results were produced. The repetition in the content of the videotape might have rendered the subliminal messages ineffective. Each videotape contained the same content of basic diet and exercise information which stressed that the viewer should eat less, exercise more, eat slower and relax. The subliminal messages were precisely the same, and thus, were repetitious of the videotape's content, and this reduced their effectiveness. It is also possible that subliminal persuasion and behavior change do not work.

Recommendations for Further Study:

There are four major recommendations for those who would replicate or improve this study. One is to improve the FEAT pre- and posttest to improve its reliability and ensure its validity. The second recommendation is to start the study earlier in the school year to allow sufficient time for reweighing, one, two, and three months after treatment.

The third recommendation would be to recruit participants who have access to kitchen privileges. This would allow participants to more easily apply what the videotapes advocated.

The fourth recommendation is to conduct this same study with the same tests and measures, but use an entirely different perceptable topic, such as one dealing with relaxation. Have on group view the videotape without subliminal messages and one group view the videotape with subliminal messages of "EAT LESS", "EAT SLOW", "GET ACTIVE", and "YOU CAN DO IT". After obtaining measures of the subjects' attitudes and behaviors toward food and exercise, there would be a clearer understanding of the effectiveness of the subliminal messages, regardless of the subject of the videotape.

Summary of Conclusions:

This study found that a commercially prepared videotape containing written and aural subliminal messages was not more effective at producing weight loss in viewers than was a videotape containing the same content but without the subliminals.

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Please place an (X) under the column which applies best to each of the numbered statements. All of the results will be strictly confidential. Most of the questions directly relate to food, eating and exercise. Please answer each question carefully. Thank you.

Always	Often	Sometimes	Rarely	Never	
( )	( )	( )	( )	( )	1. I am aware of the calorie content of foods I eat.
( )	( )	( )	( )	( )	2. I eat when I am not hungry.
( )	( )	( )	( )	( )	3. I eat faster than others.
( )	( )	( )	( )	( )	4. I can lose weight when I try.
( )	( )	( )	( )	( )	5. I follow a daily scheduled program of exercise.
( )	( )	( )	( )	( )	6. I am self-conscious about my weight.
( )	( )	( )	( )	( )	7. I exercise because I enjoy it.
( )	( )	( )	( )	( )	8. Even if I'm full, if something looks good I'll eat it.
( )	( )	( )	( )	( )	9. I do not eat some foods because they make me fat.
( )	( )	( )	( )	( )	10. Eating helps me relieve depression.
( )	( )	( )	( )	( )	11. I drink several glasses of water daily.
( )	( )	( )	( )	( )	12. When I feel rejected or lonely I eat.
( )	( )	( )	( )	( )	13. If I am hungry I eat fast.
( )	( )	( )	( )	( )	14. Exercise makes me feel calmer.
( )	( )	( )	( )	( )	15. I count calories.
( )	( )	( )	( )	( )	16. I consciously eat less than what I want.
( )	( )	( )	( )	( )	17. I exercise at least three times a week.
( )	( )	( )	( )	( )	18. I am very conscious of what I eat.
( )	( )	( )	( )	( )	19. When I get nervous I eat.
( )	( )	( )	( )	( )	20. I cut my food into small pieces.

Name____________________________ Number_____

Address__________________________ Soc Sec No ________________

____

____

Checks will be mailed by May 31 (the latest)

1) What color group were you in? __________

2) Do you believe you saw the tapes with the subliminals? ________
Why? ______________________________________
____

3) Do you feel the tapes are effective? __________

4) How did they help you?__________________________________
____
____

5) Would you like to continue watching them? __________

6) Would you consider buying the tape if you had a VCR? __________

7) Other comments you might have about the experiment:____________
____
____
____

This information is confidential. Your name will not be given out or placed on a mailing list.

Would you briefly record the food you have eaten in the past 24 hours:

Breakfast	Lunch	Dinner	Snacks

Thank you very much for your participation! Would you like the results of the study sent to you at the above address?

Educational Computing Inservice Design:
Implications from Teachers' Concerns Research

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Educational Computing Inservice Design:

Implications from Teachers' Concerns Research

Abstract

This paper provides an overview of an ongoing research effort studying teachers' concerns about educational computing. Two studies are reported. The first study identified teachers' concerns about educational computing and monitored how these concerns changed during an inservice activity. Concerns theory hypothesizes that the concerns of innovation users are developmental, beginning with self-oriented concerns, evolving through implementation-oriented concerns, and progressing to other-oriented concerns. The research findings were not consistent with the hypothesis, suggesting that the nature of the inservice and/or the characteristics of the innovation (i.e., educational computing) may affect changes in concern. The second study evolved out of the first and examined teachers' concerns about educational computing by focusing on specific educational uses of the technology (e.g., CAI, word processing, interactive video). The research findings indicated that different uses of computer technology elicit different concerns about the technology. The findings suggest that inservice designers dealing with educational computing should recognize educational computing as an "innovation bundle" and concentrate on specific applications of the technology, rather than addressing the technology whole-cloth.

Educational Computing Inservice Design: Implications from Teachers' Concerns Research

Before teachers can take full advantage of computer technology, they must modify their instructional practices to accommodate the technology. Stevens (1980) stated that two major factors affect implementation of educational computing: teachers' expertise with computers and teachers' attitudes toward computers. Most inservice attempts focus on increasing teachers' computer expertise while paying little attention to teachers' attitudes toward the technology. Such an inservice emphasis is understandable given: 1) the growing amount of information about educational computing; and, 2) the limited amount of information regarding teachers' attitudes toward educational computing. Thus, a research base focusing on teachers' attitudional responses to computer technology needs to be established. This paper reports on two studies of teachers' concerns about educational computing. The paper reports the patterns of concerns teachers had about educational computing, describes how these patterns changed during an inservice effort, and examines the relationship between teachers' attitudes toward educational computing and specific applications of computer technology.

Literature Review

Computer-related inservice design is in its infancy; the professional literature frequently fails to provide either evidence of effectiveness or a theoretical framework to support the design suggested. This is particularly evident in the affective dimension of inservice design where little attention has been given to the adult learner in a change endeavor involving computer technology.

The awareness that inservice usually involves adult learners is an important, although frequently ignored, dimension of inservice design (Orlich, 1983). Knowles (1970) described adult learners as human beings who draw heavily upon past experiences, are more problem-centered than content centered with immediacy of application a high priority, and are highly self-directed. These learner characteristics are manifested in inservice programs as learner concerns.

Teachers, as adult learners, bring a variety of past experiences to a learning situation. Podemski (1981) observed that many teachers have had limited experience with educational computing and have, instead, relied upon, and made a commitment to "non-computerized" materials and teaching techniques. Teachers having limited experiences with computing may reflect concerns related to simply gaining awareness about educational computing.

The problem-centered characteristic of the adult learner is expressed, in the area of educational computing, as a strong concern for more effectively meeting the needs of students (Stevens, 1982). Also, concerns regarding the effect of educational computing on the day-to-day management of the new technology may be more significant to some teachers than the acquisition of technical expertise (Jarchow & Hunter, 1983). If an inservice program does not address the concerns that are relevant to the teachers, then some teachers, as adult learners, may redirect their attention away from the inservice and perhaps away from educational computing.

Understanding how adult learners respond to innovations and how responses change as a result of inservice efforts has been systematically researched using the Concerns-Based Adoption Model (CBAM) (Hall, Wallace & Dossett, 1973). The CBAM suggests that inservice efforts may be less than optimally successful because inservice designers fail to consider where teachers are in the process of acquiring new attitudes, understandings, and skills relative to the given innovation (Loucks & Hall, 1977). The model suggests that when adult learners engage in a new learning endeavor, they pass through predictable stages of concern. These stages reflect a developmental movement from a lack of awareness concerning an innovation to a general seeking of information, to personal, management, and consequence concerns, and finally to concerns regarding collaboration and further innovation. Brief definitions of the stages of concern are shown in the Appendix.

While the CBAM is generally accepted in the inservice design and change process literature, the model has received limited use in designing or researching educational computing inservice efforts. Bartel (1984) and Wedman and Strathe (1984) used the stages of concern framework to design faculty development programs, but did not formally assess concerns. Wedman and Heller (1984) described teachers' concerns before they entered an inservice effort but did not investigate how these concerns changed during an inservice effort. Thus, the purpose of Study #1 was to test the changes in concerns as hypothesized by the CBAM. Specifically, Study #1 assessed teachers' concerns and described the effect of an inservice effort on their concerns about educational computing. Study #2 evolved out of Study #1 in an effort to understand better the unpredicted results of the earlier study.

Methods & Findings: Study #1

The participants in Study #1 were classroom teachers who had voluntarily enrolled in a university-offered course, "Microcomputers in Education," for which they paid their own tuition. Sixty-five were females (71%);

twenty-six were males (29%). Forty-four taught elementary grades (48%); seventeen taught middle/junior high grades (19%); twenty-six taught high school (29%); four taught grades K-12 (4%). The teachers varied in years of teaching experience (one to forty-four years) and amount of computer experience (novice to computer science instructors). Both pre and post data were collected from 91 of the 104 participating teachers.

The course was offered at six different sites across a central midwestern state during the fall of 1982 thru the Spring of 1984. Each offering was in response to requests from administrators and teachers for computer-related inservice. The course consisted of 30 hours of classroom instruction and several out-of-class assignments. The actual duration of the inservice course varied from two weeks (five hours per day, three days per week) to eight weeks (three and 3/4 hours per day, one day per week). The course placed emphasis on transferring course content to the teachers' own practices. The same content was used in each course and included such topics as microcomputer operation, elementary programing, software selection, evaluation, and utilization, and simple authoring systems.

The Stages of Concern Questionnaire (Hall & Rutherford, 1976) was used to measure teacher's attitudes toward educational computing. The items on the questionnaire represent the seven stages of concern; five items comprise the scale for each stage. Estimates of internal consistency (alpha coefficients) for stages range from .64 to .83. Hall and Rutherford (1976, pp. 12-20) describe several studies which indicate the SoCQ is a valid measure of the hypothesized concerns.

The SoCQ was administered to all teachers enrolled in the six offerings of the course. The preassessment was conducted during the first class meeting prior to any discussion of the course or its content. The subjects were told that the results of the questionnaire would be used to evaluate the effectiveness of the course.

The SoCQ was scored using the SoCQ Quick Scoring Device (Hall & Rutherford, 1976). The Quick Scoring Device converts raw scores to percentile scores for each stage of concern. A higher percentile score is associated with greater concern intensity. Pre and post data were then prepared (compiled and averaged) for comparison of teachers' concerns for each site and for the entire group.

For interpreting SoCQ results, Hall and Rutherford (1975) suggest that "...due to the nature of the questions being asked, identification of trends and patterns in the data seems more valid than conducting a series of tests of statistical significance." (p. 8) Following this suggestion, each teacher's pre and post SoCQ percentile scores were graphed thus forming "concerns profiles." The compiled data for each site and the entire group were also graphically represented.

Examination of the preassessment profiles revealed that for most teachers entering the inservice course, lower level, more self-oriented concerns, were typically most intense (see Figure 1). These informational and personal concerns reflected interest in the general characteristics of the innovation and the relationship between one's role and the demands of change. In addition, however, it was observed that approximately 1/3 of the participants displayed a "two-humped" profile with high intensity concerns in both information and collaboration (See Figure 2). This profile was reflective primarily of those individuals who had considerable computer experience prior to the inservice effort.

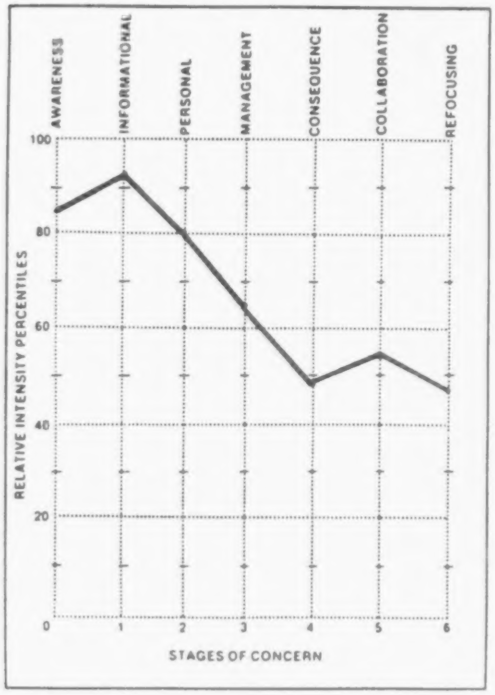

Figure 1.

Preassessment concerns profile, entire group, Study #1.

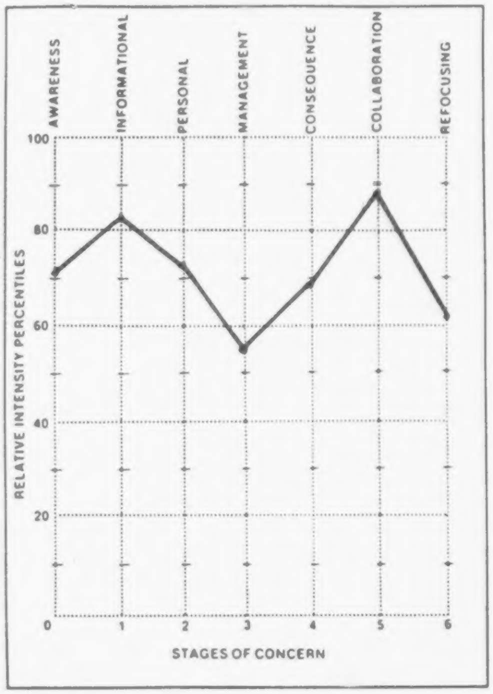

Figure 2.

Preassessment concerns profile, "two-humped," Study #1.

Analysis of the postassessment profiles (see Figure 3) revealed several unexpected patterns. While the work of Loucks and Hall (1977) has suggested a developmental progression in concerns changes, intermediate concerns (i.e., management) typically remained lower in intensity. In addition, it was noted that the intensities of higher level concerns (consequence, collaboration, and refocusing) increased although lower level concerns, evident in the preassessment profiles, did not change markedly, somewhat in contrast to the progression suggested by the CBAM model. It should also be noted that the postassessment profiles resembled the "two humped" profile commonly found among the experienced individuals.

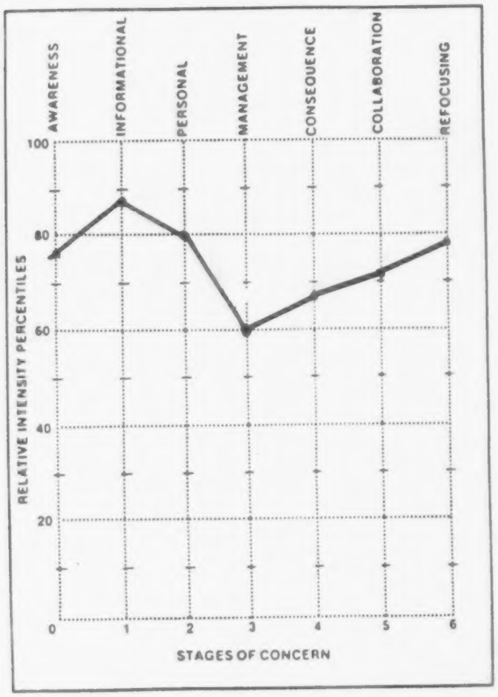

Figure 3.

Postassessment concerns profile, entire group, Study #1.

Discussion: Study #1

The preassessment profiles in Study #1 suggest that inservice providers must be cognizant of the heterogenity of teachers' concerns about educational computing. Inservice experiences for many individuals need to address self-oriented concerns while experiences for other individuals need to address both self-oriented and other-oriented concerns.

The surprisingly low intensity of implementation-oriented concerns at both the pre and postassessment points raises several questions. The low intensity may be suggestive of the nature of the inservice effort itself which encouraged but did not require teachers to actually implement educational computing activities in their classroom. Or, perhaps implementation-related concerns did not become intense because the teachers were not given sufficient time to fully implement the innovation and manifest implementation-related problems and the associated concerns. It may also be posited that, while teachers became comfortable with the elementary aspects of educational computing (e.g., system operation, use of drill and practice software), they also became aware of more advanced aspects of the technology (e.g., word processing, interfacing with other devices). Thus, the postassessment profiles may be actually depicting concerns about more than one aspect of educational computing. This explanation is consistent with the multi-faceted nature of educational computing and served as the impetus for Study #2 which examined how teachers' concerns vary when different aspects of educational computing are considered. It was predicted that, if teachers' concerns do vary, then more familiar applications will be associated with more advanced stages of concern.

Methods & Findings: Study #2

In Study #2, the SoCQ was used to assess teachers' concerns about different aspects of educational computing. Five elementary schools (E-1...E-5), one middle school (M S), and one high school (H S) from a midwestern school district volunteered to participate in the study. Teachers at the schools completed one of four randomly selected versions of the SoCQ, each version focusing on a different application, specifically, computer assisted instruction (CAI), computer managed instruction (CMI), interactive video (IV), and word processing (WP). The teachers were also asked to complete an open-ended concerns question for the particular application. Table 1 lists the schools involved in Study #2 and indicates the number of teachers completing each version of the SoCQ. Concerns profiles were constructed for individual teachers and groups of teachers responding to the same application of educational computing.

Table 1. SoCQ Questionnaire Version by Schools

	<----------- Schools					------------>		
SoCQ	E-1	E-2	E-3	E-4	E-5	M S	H S	Totals
CAI	4	4	5	5	3	8	12	41
CMI	5	4	5	5	3	6	14	42
IV	4	4	6	4	3	7	10	38
WP	6	4	6	6	2	8	16	46
Totals	17	16	22	20	11	29	52	167

Initial examination of the four sets of group profiles (by application) revealed that when teachers consider different aspects of educational computing, different types of concerns are NOT evident (see Figures 4a-d). This finding appears to suggest that teachers' concerns about educational computing are essentially the same, regardless to the particular application being considered. Closer examination of the concerns data revealed, however, that such is not the case.

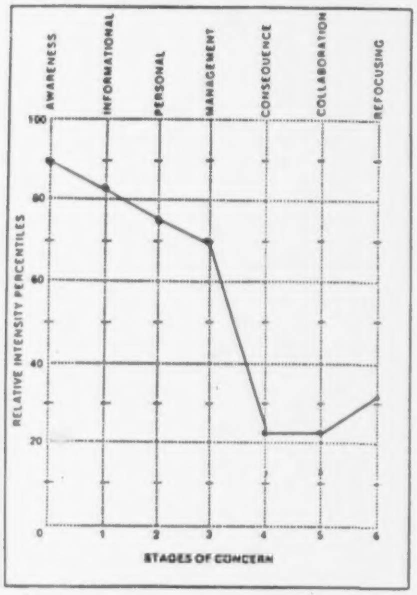

Figure 4a. CAI concerns

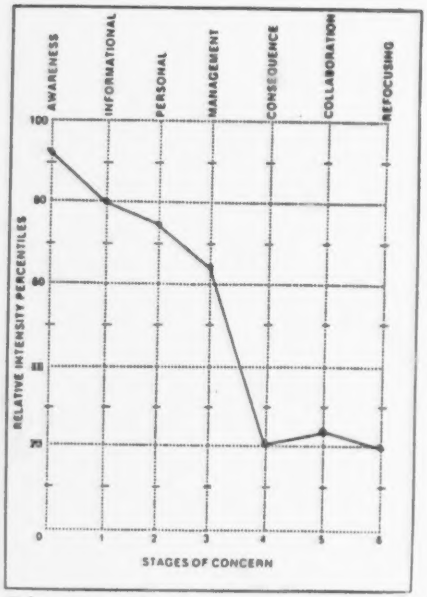

Figure 4b. CMI concerns

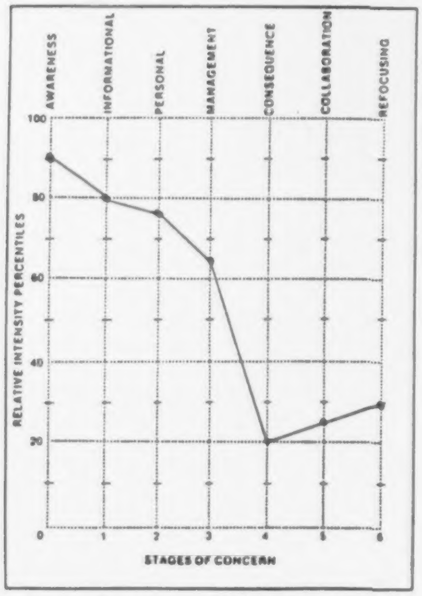

Figure 4c. IV concerns

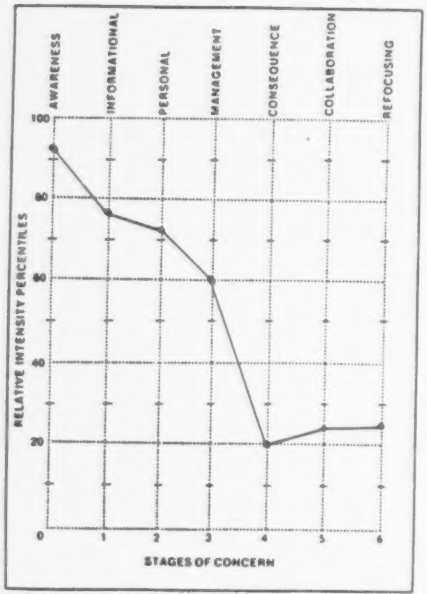

Figure 4d. WP concerns

When the individual profiles are examined, a different picture becomes evident. By examining the individual profiles, and noting which concern has the highest intensity, a simple matrix of concerns by applications can be created. (Note: In those cases where two concerns had the same intensity, the open-ended data was used to help classify the profile.) Such a matrix, shown in Table 2, can be used to identify, for a given application, the percentage of teachers having a particular concern as most intense. Three patterns are noteworthy. First, the percentage of teachers having intense awareness concerns was lower in CAI than in other applications. Second, the percentages were more widely distributed in CAI than in other applications. Finally, a large majority of concerns about interactive video were in the awareness stage.

Table 2. Concerns x Application Matrix

Stage of Concern	Application CAI	 CMI	 IV	 WP
Awareness	42%	60%	70%	59%
Information	35%	26%	23%	29%
Personal	15%	12%	7%	8%
Management	8%	2%	--	4%
Consequences	--	--	--	--
Collaboration	--	--	--	--
Refocusing	--	--	--	--

Note: Cell entries indicate, for a given application, the percentage of teachers whose concerns were most intense for a particular stage of concern.

Discussion: Study #2

The variation in teachers' concerns about different educational computing applications was not evident in the composite group profiles. Yet, when the concerns data was considered on an individual basis, important differences became evident. Teachers' concerns about educational computing do vary, depending on which application is being considered. This finding seems to support the notion that educational computing is an "innovation bundle," that is, a collection of several specific innovations each of which elicit potentially different concerns. The finding is also consistent with the results of Study #1 in that the two-humped profiles may have actually been representations of concerns about more than one innovation. Study #2 also suggests that inservice designers, evaluators, and researchers need to focus on specific aspects of educational computing rather than on the entire innovation.

Conclusion

This paper reported on two studies examining teachers' concerns about educational computing. Collectively, the studies suggest that educational computing is an innovation bundle rather than a single, unitary innovation. If educational computing is an innovation bundle, then the problem for inservice designers is, in part, one of "unbundling" the innovation. Care should be taken, however, to not mistake the end result of such an analysis as a blueprint for designing inservice. Some instructional design theories, for example, Reigeluth's (1979) elaboration theory, suggest that instruction should be organized in a general to specific structure. Educational computing content readily lends itself to such a structure. An inservice program designed to expose teachers to several aspects of educational computing could serve as the "epitome." Later inservice efforts would then concentrate on more specific aspects of educational computing. As the inservice begins to focus on more narrowly defined applications, the inservice designers should then begin to collect and use concerns-related data as part of their audience analysis.

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Appendix

Definitions of Stages of Concern About the Innovation.

Stage	Title	Definition
0	Awareness	Unaware of or unconcerned about the innovation.
1	Information	Concerned about the general characteristics of the innovation.
2	Personal	Concerned about the relationship between one's role and the demands of the innovation.
3	Management	Concerned about the management and organization of the innovation.
4	Consequences	Concerned about the impact of the innovation on student outcomes.
5	Collaboration	Concerned about working with others using the innovation.
6	Refocusing	Concerned about something better than the innovation.

Graduate Student Contributions to AECT
and to the
Future of Educational Technology

Paul W. Welliver

A Summary of a Presentation for a Session
entitled
Directions in Research, Instructional Development
and
Professional Activities for Graduate Students and Others

AECT Convention
Las Vegas, Nevada   January 19, 1986

It is a common and generally accepted feeling among many graduate students that they are necomers to a profession and therefore they should be seen and not heard, sit obediently at the feet of experts to catch pearls of wisdom, and generally play a subserviant role within a professional association. This perception is just not true of AECT!

This is not to deny that there is a great deal to gain from "rubbing elbows" with the scholars and leaders in the field by associating with them at AECT functions. These contacts should be approached, however, with the assurance that, as graduate students in a rapidly evolving field, you have a great deal to contribute to that growth and change. I will try to outline a few of the ways in which this can be done.

1. Introduce a fresh viewpoint and perspective.

You must be aware that you are growing up and maturing in the computer generation. Many of the established leaders in our field came out of the lantern slide generation. These two groups think differently. This is not to say that the elder generation hasn't developed some dramatic innovations and thoughtful insights. It is, however, to emphasize that you are able to pick up where they left off and approach instruction from a significantly different perspective.

2. Challenge tradition

A lot of what has been done in education made good sense at the time and under the circumstances in which it was developed. A background, a foundation, a tradition are all necessay elements of a field. But they can not be permitted to dominate a field - particularly the one in which we work. You are in the best position to suggest alternatives to some of these traditions and require that all of us examine the basic premises and assumptions upon which we operate. Be prepared to fail and be wrong but don't let that inhibit you from venturing in new directions.

3. Provide a balance.

As you challenge tradition, recognize the basis and value of that tradition. In so doing, help the profession to achieve an appropriate balance between residual elements of the past, which continue to provide value, and the exciting new dimensions of cutting-edge technololgies. The concept of balance is important. Leaning too far in either direction often causes a system to topple and fall.

4. Provide vitality to the profession.

You, with your youth and new perspective, are in a unique position to add a spark of vitality to professional gatherings. This is not to imply that an assembly of mature professionals is necessarily dull. Indeed, quite to the contrary! But your seniors in this field are both enriched and inhibited by the past. You, unshackled by much of what came before, can enrich wisdom with openminded enthusiasm.

5. Get involved and serve.

Actually this is not primarily something that you can do for AECT and the profession. Rather, as you contribute your time and energy it is, in the long run, something that the profession can do for you. It is difficult for me to conceive of an individual being able to make significant progress professionally without this type of involvement. The personal relationships and networks that are achieved are invaluable as your career develops. I can not even estimate the number of times that I have needed information or assistance when I have been able to pick up the telephone and call someone who I met through my professional involvement. The more involved you are, the more people that you meet and the more you develop that network of support. It is a very positive version of the old saying that it isn't what you know but who you know.

6. Develop a special network among other graduate students.

A few years ago a major effort was initiated to develop a network of graduate students. All graduate programs were contacted, a student representative was identified at each one, and a regular newsletter was circulated. Unfortunately, it was a time when AECT was absorbed in a lot of other priorities and the effort was abandoned after about a year. I think that the time is now right for such an project and would challenge you to initiate a graduate student network. I would be glad to provide some background from the past effort to assist in getting the idea underway. In fact, at one time it was even suggested that such a group might seek division status in AECT. One wag even proposed that it be known as the Division of Graduate Students or DOGS. He felt that it was an appropriate acronym in light of the life that he was leading in graduate school!

AECT has a tradition of planning activities which will bring together the experienced professional along with the younger newcomers to the field. You are the ones who provide one of those two important dimensions to our profession. I invite and urge you to capitalize on this significant professional role.

BEST COPY AVAILABLE

Emerging Trends in Educational Technology Research

Bill Winn
University of Washington.

AECT Annual Convention
Las Vegas, January, 1986.

The topic of this paper, or something very much like it, has become a fixed feature of the program of AECT conventions. Whether this means that the planners of each year's program do not pay attention to what has been presented on previous occasions, whether each attempt at addressing the question has failed, or whether there is a genuine and sincere concern that we constantly ask each other what researchers in educational technology should be doing, is not clear.

This year's examination of the issue attempts to answer four over-arching questions. The four questions are:

i. What is the nature of inquiry in Educational Technology?
ii. What do we need to find out?
iii. How do we go about it?
iv. What do we do with our findings?

Less cryptically, these questions point to a need to examine: why we do research in our area and what the characteristics of that research might be; the types of research questions we should and should not be asking; what are the most appropriate methodologies for finding answers to our research questions; and what are the characteristics of a report of research that make it "good" and utlimately suitable for publication. Let me repeat, however, that a number of wiser heads than mine have tackled these questions before and have come to conclusions that are generally in agreement with those that I shall present. The reader might wish to consult these sources. (Torkelson, 1977; Salomon, 1978, 1979; Wilkinson, 1980; Clark, 1983; Gerlach, 1984; Heinich, 1984; and many others).

The Nature of Inquiry in Educational Technology.

In a recent address, Lee Shulman (1985) observed that arguments about the modes of inquiry that are common in the social sciences are almost totally absent in the "hard" sciences. By and large, physicists, chemists, astronomers and the like take methodology for granted. They agree about how research should be done. There are two reasons for this. The first is that the social sciences are younger than the natural sciences and have had less time to arrive at a consensus over methodology. The second is that the factors that social scientists study are more complex and less clear cut than those studied by their counterparts in the "hard" sciences.

Shulman's observation would be reason enough for beginning this paper with a look at the nature of inquiry in our discipline. But the matter does not end there. If one looks carefully at the literature, one is left with the impression that, with some notable exceptions, the matter of the nature of inquiry in our field has never been addressed adequately. We do not have a clearly-defined "philosophy of science" to guide us.

The exceptions will be familiar to most of you. They include some of the central ideas set down by Heinich (1970, 1984) about the nature of Educational Technology, the discussion of the role of prescriptive theory by Reigeluth (1983) and by Clark (1983). The issue is also addressed less directly by Jonassen (1984) in his philosophical analysis of mediation, Brody (1982), who describes a "functionalist" agenda for research on pictures, and Streibel (1985, & in press) in his critical analysis of educational computing. Notice that I have not listed any of the numerous papers at previous conferences dealing with naturalistic research methods. This does not mean that these papers have no value. They certainly do. But they do not delve deeply enough to define the nature of inquiry in our field.

The purpose of inquiry in any discipline is simply to find things out. We find things out for a number of reasons, not least among which is that we are by nature curious. This, of course, is a terrible truism, which is why we tend not to dwell upon the point when we initiate people into research. But the satisfaction of curiosity is supremely rewarding, and from this satisfaction comes the enjoyment one gets from doing research. It is sad that so many graduate students feel that doing research is drudgery, or worse, and that, largely because of this, they do no more once they have their dissertation out of the way. (Maybe, as Clark (1978) implied, this is also the attitude of their supervisors, in which case they are at a double disadvantage). But the fact remains that research is very satisfying, whether it leads to a significant contribution or not. Put another way, there is nothing wrong with doing research for its own sake.

Frequently our obsession with coming up with "significant" or "practical" results makes us devalue the work that we really enjoy, and turns us away from doing more.

The curiosity that inquiry satisfies is curiosity about why things are the way they are, and why they behave the way they do. Research therefore becomes a quest for explanations. In our area, this might involve explanations of why one instructional method succeeds where another does not, why some delivery technologies are thought of as more reliable or easier to learn from than others, why administrators will spend money on some technologies and not others, why smart students learn better from some instructional methods than less able students, and so on. The explanations that researchers find for such phenomena will, one hopes, fit together in non-contradictory ways into a body of theory which, in turn, will direct us towards what explanations to seek after next. This is the familiar cycle of research building theory from which research hypotheses are derived, and is described in any research methods text. The result of this type of inquiry is descriptive theory that is typical of the natural sciences (Simon, 1981).

A number of scholars in our field find even greater satisfaction when the explanations they find are applicable to practical problems. In these cases, the purpose of research is the generation of prescriptive theory. It is this type of theory that guides the decisions that instructional designers make, a process that is the pivot around which the whole field of Educational Technology turns. As Reigeluth (1983) has stated, prescriptive instructional theory consists of an integrated set of principles that state which methods to use given certain outcomes to attain and conditions under which instruction is to occur. Simply put, these principles take the form: "If x and y then do z". For example, if you want students to be able to solve word problems involving fractions (outcome), and if the students know how to perform the four basic arithmetic operations on fractions and have high fluid ability (conditions), prescriptive theory might point to using an inductive method with lots of feedback. A number of scholars in our field have drawn together bodies of prescriptive theory from research that are of value to instructional designers. These include all of the authors in Reigeluth's (1983) volume, the work of Fleming and Levie (1978), and the prescriptions for designing concept lessons offered by Merrill and Tennyson (1977).

Inquiry in our field, then, serves three purposes: it satisfies our curiosity about the way things are; it leads to the discovery of explanations about what happens when people learn, interact with technologies, and so on; and it allows the development of prescriptive theory that can inform decision-making. It does, however, have one other important characteristic, which Shulman (1981) described as having method or orderliness. Regardless of which particular research paradigm you subscribe to -- experimental, historical, ethnomethodological, phenomenological, evaluation -- all inquiry that is worth anything is rigorous. What this means varies from paradigm to paradigm. However, scholars of every kind should be able to point to examples rigorous of inquiry within their specializations. It is terribly wrong to think of one paradigm as being necessarily better, than another. But, as we all know, some experimental researchers look down upon naturalistic inquiry as somehow less rigorous and inferior, while some naturalistic researchers scorn experimental research for lacking applicability. Such divisive squabbles are counterproductive and unnecessary. It is far better to accept different standards of rigor (see, for example, Guba, 1981) and acknowledge that all types of good research make a contribution to our field.

At the risk of belaboring the point, I would like to take this argument one step further. Increasingly, we read that prescriptive theory and design are unnecessary, and that we should rely upon the expertise of teachers and other professionals "in the field" to make instructional decisions (see Nunan, 1983). However, the same standards of rigor must apply here. The ability of expert professionals to "reflect in action" (Schon, 1983) must not be thought of as a pretext for sloppiness. Decisions based upon experience, intuition, hunches and "plausible reasoning" (Hunt, 1982) need to be just as sound and carefully deliberated as decisions based upon a more formal prescriptive theory.

What do we need to find out?

A number of scholars have reviewed the progress of research in Educational Technology over the years, and have been able, from this historical perspective, to point to the gaps in what we know (Torkelson, 1977; Clark, 1983; Gerlach, 1984). This approach has also led to the conclusion that we have not been asking the right research questions, that we have not been trying to find out what it is really important to know.

The development of research in our area is generally acknowledged to have followed the following stages:

1. Media comparison studies, in which the effectiveness of one medium is compared to that of another medium or to "traditional" classroom instruction. Clark (1983), among others, has demonstrated convincingly that this research is a complete waste of time because there is nothing intrinsic in the media by which instruction is delivered that can possibly affect how and what people learn.

2. Media attribute studies. Here, researchers attempted to identify specific attributes of the different media which made them unique and which might account for differences in outcomes when different media were used to teach. Again, there are conceptual and methodological difficulties with studies of this kind which preclude their contributing much of value to theory.

3. Aptitude-Treatment Interaction research. Snow and Salomon (1968) pointed out a long time ago that differences in student aptitude and ability would "mask out" main effects in media research, and that they should be included as factors in research designs in our field. A great many studies have now been conducted using the ATI paradigm, often claiming to find interactions, although, again, there are many methodological problems that make the majority of these studies suspect (Cronbach and Snow, 1977).

4. Learning strategies research. While not within the

"mainstream" of educational technology research, a great deal of work is now being conducted on the strategies students use to learn (Brown, 1981; Brown, Campione and Day, 1981). Just because a student has ability in a particular cognitive skill does not mean that the ability will be used to learn when it is appropriate to do so. The use of strategies by students is an important area for researchers in our field to address.

5. Research on students' attributions. Salomon (1981, 1982, 1983, 1984) and Clark (1983) both state that the importance of a particular instructional technology derives from the value and difficulty attributed to learning from it by students. Again, this research is not yet thought of as "mainstream" educational technology research. However, it points towards an important future development.

This evolution of research illustrates both the good and the bad, the productive and the less productive, in what we have done in the past. Generally, the more recent research is more valid and describes things more accurately, (although there are still people doing media comparison studies, in spite of the fact that we know they are a waste of time). Also, this type of research is conclusion oriented, and represents only part of what educational technologists do. We have a considerable tradition of decision oriented research, which is conducted under the rubric of "Instructional Development". From our past research, we have learned some useful things about how student characteristics are related to different instructional methods, though this information is too fragmented to qualify as an instructional theory. We are beginning to discover the relationships among task, student characteristics, methods and strategies that students actually use. We have a clearer, though by no means complete picture of the cognitive processes that underlie learning associated with memory, attention, recall, imagery, problem solving, and so on. On the other hand, for all our efforts, we have no theory that relates media or technologies to learning (nor, some might say, is such a theory potentially interesting nor even possible). We have very poor procedures for making instructional decisions based upon the most recent cognitive research. All of the design models I can think of are built upon behavioral premises and principles. Such prescriptive theory as we have is so incomplete as to appear incoherent at times, and is made up of instructional principles that might have "local" validity, but which, by and large, are not particularly robust or generalizable.

From this, it is possible to identify some things we should be finding out. Whether these will develop into future trends or remain pious hopes remains to be seen. We shall look first at two general research areas, and then at several more specific types of question.

Prescriptive Instructional Theory.

We must continue to conduct conclusion-oriented research to uncover prescriptive instructional principles which will fit together in a coherent and stable theory. In spite of a great clamor to the contrary (Phillips, 1983; Eisner, 1984), there is still a need in education for both principles derived from experimental research and heuristics derived through qualitative modes of inquiry (see Howe, 1985). Indeed, there is increasing evidence from Philosophy (Schon, 1983), Cognitive Science (Hunt, 1982) and Artifical Intelligence (Feigenbaum, 1985) that both experimentally verifiable factual knowledge and intuitive tacit knowledge are necessary for the development of the levels of expertise required for the successful execution of higher cognitive processes. An "expert" uses experience and intuition to fill in what theoretical principles do not deal with. Likewise, an expert system relies on a knowledge base, derived from public knowledge, and a set of heuristics, derived from human experts, in order to function.

Our research must therefore attempt to discover, verify and establish as complete a prescriptive theory of instruction as possible, on the understanding that its inevitable incompleteness can be made up for by capturing the heuristic knowledge of experts. This research requires that we continue to seek knowledge about the factors that are necessary, not merely sufficient, to bring learning about (Clark, 1983). In practical terms, this requires the study of basic cognitive processes, human abilities, learning strategies, and attributions of learners' successes and failures to the various methods and technologies we employ when we teach. These factors are highly interdependent, and deserve study in contexts where that interdependence is not destroyed, and even becomes the object of the study itself.

Decision Oriented Research.

Heinich (1984) has made the point that the most important type of research for educational technologists to conduct is that which leads to solutions to practical problems within contexts in which the complexity of the "real world" has not been "controlled for" as it is in experimental research. The emphasis is on the application of knowledge to solve problems, and loudly echos the definition of "Technology" upon which our field is built (Galbraith, 1969).

There are, I believe, three aspects to this kind of research that need to be considered. The first of these is the development and validation of procedures for conducting decision-oriented research. The procedures that we have to do this -- our instructional development and design procedures or "models" -- have by and large been developed intuitively. As Gerlach (1984) has pointed out, with rare exceptions, they have not been submitted to the kinds of empirical testing that we require of the postulates of theory. Gerlach would have us study the behavior of educational technolgists themselves, requiring that design models become independent variables in research studies. In this way, we would be able to ascertain whether, and which, design procedures result, ultimately, in superior student performance. We have not yet answered the research question: does following a design or development model lead to superior instruction?

Second, we need to develop ways of studying complex systems without having to dismember them. Precisely what needs to be done in this regard is less clear. However, the concepts and methodologies of General System Theory (Bertalanffy, 1968) would serve as a good place to start. By and large, I believe that educational technologists have completely missed the point of System Theory, and have confused being "systemic" with being "systematic" (Davies, 1981). The so-called "system approach" has resulted in little more than "models" of linear procedures which, if followed, lead from the statement of a goal to the creation of a unit of instruction. The emphasis is heavily biased towards "front-end" analysis and field testing, with little guidance being given at the decision-making stage where methods are selected to match the conditions and outcomes that the analysis has clarified. The real purpose of System Theory, however, was to provide ways of managing great complexity, originally in living organisms. The decisions through which instructional methods are selected require that we deal with such great complexity. Students are very complex, and the multivariate nature of learning and instruction simply cannot be dealt with by our terribly naive "system approach". What we need to find out is how the ways for dealing with complexity, suggested by those few educational technologists who have really understood System Theory, can be applied in practice to the making sound, though complex, instructional decisions. The work of Heinich (1970) on the complexities of the management of instruction, of Pask (1984) on self-organization in complex systems involving students and instructors, and of Winn (1975) and Beckwith (1984) on open system models of learners, is instructive in this regard.

Finally, we need to treat ID projects very seriously as case studies. Obviously, the primary purpose of an ID project is to get a problem solved as efficiently and effectively as possible.

However, we lose a great deal of valuable information every time that those in charge of a project fail to describe it in the literature. I have argued elsewhere (Winn, 1981) that ID is a valid and valuable form of research. By the standards that are applied to experimental research, ID falls short when it comes to generalizability of findings. Because ID projects set out to solve local one-shot problems, and because few variables if any are controlled, one might argue that the experiences would be so specific to that one case that they could not possibly be of interest to other developers. But it is a question of whether the mug is half empty or half full. Looking at it the other way around, there are certain common elements in every ID project: there is a "client", a need, a goal, a set of objectives, a solution, try-out and implementation. How each of these is handled differently under different circumstances is very instructive, especially when one considers that the developer seeking "methods" which might help in a particular project will certainly be intelligent enough to adapt the suggestions of a fellow developer to fit his own needs more precisely. The case study seems to be the best way to accomplish this, and educational technologists should be encouraged to use it.

The following specific research needs and questions are not presented in any particular order. They encompass both conclusion- and decision-oriented research.

Metacognition.

There is increasing evidence that students are capable of monitoring their own cognitive performances and of making deliberate changes in the strategies they use to learn (Brown, 1981; Brown, Campione and Day, 1981). This is generally seen as something to be desired, for it allows students control over what and how they learn. There is, however, a Catch-22 as far as educational technologists are concerned. It involves the question of who knows best, the designer-instructor or the student? For example, if an instructional designer chooses a particular instructional method on the basis of prescriptive theory, expertise, or what has worked in the past, then it is assumed that the method is indeed the best, given the circumstances. Now, if the student monitors his performance and decides that another method would be better, who is right? On the one hand one might argue that if students "interfere" with what an "expert" has decided is best, then design is a waste of time. On the other hand, if students do indeed know more about what is good for them than designers can possibly know on the basis of their meagre learner analysis, then design helps students take the intermediate step between complete novicehood and mastery of learning strategies. In either case, design becomes unnecessary. But in the latter instance, the reasons for this are positive.

What comes out of this conundrum is the apparent need for research into the relationships among prescription and learner control of instructional methods. Some work has already been carried out on this problem (Carrier, Williams and Davidson, 1985; Tennyson, Christensen, Walsh and Hajovy, 1985) in the study of computer-assisted learning. However, we need to find out whether the prescription of methods by designers or instructors is antithetical to or facilitative of metacognitive skill in students. In this way it should be possible to identify at what point a student should be allowed to make metacognitive decisions rather than abide by prescribed ones.

Perceptions of Media and Technologies.

The work of Salomon (1981, 1982, 1983, 1984) on attributions of qualities to media by students has opened up a new area that educational technologists should study. The suggestion is that the effects and effectiveness of different media and delivery technologies are determined mostly by how the students perceive them. This includes whether the medium is considered to be "easy" or "hard", whether the student thinks it is worthwhile putting any effort into it, and so on. In addition to Salomon's work, Krendl has studied the effect of "set" (Krendl and Watkins, 1983) and "preconceptions" (Krendl, 1985) on television viewing. Salomon (1985) has turned his attention towards similar questions involving computers. These studies serve as models for others to follow.

Technological Constraints.

While it has been established (Clark, 1983) that it is instructional methods that have an influence on learning rather than media or delivery systems, the efficiency with which methods can be used is frequently constrained by the technologies available for the delivery of instruction. Thus, while Clark has claimed that a teacher can use any method that a technological medium can, it might not be very efficient for the teacher to do so (see Petkovitch and Tennyson, 1985). For example, it is theoretically possible for a teacher to have 54000 overhead transparencies on file in a classroom, which the teacher selects from as needed. However, to do this is impractical, and far less efficient than using a videodisk for the same purpose. Likewise, it is far less practical to have students commute hundreds of miles to class each week than to have them study pre-packaged self-instructional materials in their homes.

We therefore need to find out about the efficiency of various combinations of instructional methods and delivery technologies in order to add a practical dimension to prescriptive theory concerning instructional methods. A recent study by Wager (1986) appears, at first glance, to be yet another media comparison study. In it he compares CAI and television for teaching army teletype operators. However, he was not interested in whether one technology taught the soldiers more or better than the other. His concern was in cost effectiveness, and a large part of his data consists of detailed costing out of teaching via the two technologies. This is a very useful type of study to conduct, and we need to do more of them with a variety of methods and delivery systems.

Optimization Methods.

The roots of instructional design, some claim (Glaser, 1976), lie in Simon's book The Sciences of the Artificial (Simon, 1969). Here, Simon describes design as a process whereby decisions are optimized on the basis of the demands of a task and the constraints that are imposed upon its performance. Optimization procedures, such as statistical decision theory, work very well in some sciences, like engineering and maybe medicine. However, as Glaser has mentioned (1976), they only work in Education in "trivial" instances. This is because, as we saw above, education is concerned with complex, multivariate processes that we do not yet fully understand, let alone control. However, this does not mean that more precise procedures for instructional decision-making should not be sought after. The speed and capacity of today's computers makes it possible to handle those very complex multivariate situations that instructional decision-making is involved with. Some work has begun on this problem, again in CAI research. Tennyson and his colleagues (Johansen and Tennyson, 1983) have developed the Minnesota Adaptive Instructional System (MAIS) which has some of the attributes of a complex instructional decision-maker. The algorithms involve, among other things, the calculation of of probabilities using Bayesian statistics. We need other mathematical models of this type to help us optimize instructional decision-making.

"Expert" Design Systems.

Everyone is talking about "expert systems". These are computer programs in which has been captured the intuitive tacit knowledge of experts, expressed as decision rules through the agency of "knowledge engineers". We need to find out whether it is feasible and practical to capture the expertise of instructional designers in this way and create expert systems that do instructional design.

This would be relatively easy to do. But the next logical step is less simple. If we can create expert instructional design systems, it should be possible to create CAI systems that design themselves as they interact with students. In other words, the prescriptive principles embodied in an instructional theory would be "invented" by the system as it "got to know" each student it was teaching. In effect, a separate theory of instruction would develop for each student, offering the ultimate in adaptive instruction.

Significant steps have already been taken towards constructing these self-designing systems. They are to be found in self-improving intelligent tutoring systems, developed by such researchers as Kimball (1982) and O'Shea (1982). These systems function by changing instructional strategies, either on the basis of how well the student is doing or arbitrarily at predetermined intervals, and seeing whether or not the change in strategy improves or degrades the student's performance. The algorithm is, once again, based upon probability. Based upon the success of the strategy, it is either retained or changed again. We need to find out how effective such self-improving systems are, and to develop more sophisticated algorithms for the modification and retention of instructional strategies.

Presentation Formats.

With the advent of intelligent tutoring systems (Sleeman and Brown, 1982) comes the need for developing a whole variety of ways of displaying information to students. To date, the natural languages that have been used in intelligent CAI have been verbal langauges, like English, French and Russian. However, research on the effectiveness of graphics (Winn, 1986), pictures (Levin, Anglin and Carney, 1986) and videotex (Winn, Ellis, Plattor, Sinkey and Potter, 1985) in instruction has firmly established that other ways of presenting information are now as feasible to use as text, and are often more effective. The problem is that in order to get information from a knowledge base in a computer, be it constructed from decision rules, a network of propositions or one of many logics, into a form that the student can comprehend requires routines that themselves follow particular sets of rules. In the case of verbal language, these rules are the language's syntax. There is no syntax for the non-textual representation of knowledge. A number of scholars have attempted to describe grammars of pictures and graphics (Doblin, 1980; Szlichcinski, 1980). However, we simply do not know enough about how pictures and graphics convey meaning to enable us to write decision rules for CAI with the same power and precision as the rules we have when screen presentations are textual. There is a tremendous amount of research to do in this area before we can begin to exploit these forms of representation to their fullest.

There are, of course, other things we need to find out. But any report of "future trends" must limit itself to the most likely to be manageable. I believe that the items just mentioned are pretty "sure bets" for the future of research in our field.

Methodology

A section on methodology is expected in a paper such as this. However, given the plethora of papers and articles on the methodology of educational research that have appeared recently, what I have to say on the matter will probably be redundant. I will therefore be brief.

First we must remind ourselves that, whatever method we use to conduct our research, we must apply it with discipline and rigor. The arguments in support of this contention were made earlier, besides which they should be obvious.

Second, let us not forget that our discipline is concerned with both conclusion- and decision-oriented research. The methodologies for each differ, as we all know. Again, recall the arguments made above that instructional development is a form of research, and that the data instructional developers gather should be reported.

As far as the current debate about qualitative versus quantitative methods is concerned (Phillips, 1983; Eisner, 1983; Smith, 1983; Miles and Huberman, 1984), I am bothered by the feeling I get that proponents of each class of method are proposing alternatives to rather than complements to the other class of method. Given the eclectic nature of research questions in our discipline (and in Education generally), we must have at our displosal a whole battery of methods to deal with the different types of things we need to find out.

There are a number of ways in which experimental/quantitative and naturalistic/qualitative methodologies can complement each other. Howe (1985) has stated that "quantification extends, refines and crosschecks qualitative knowledge" (p. 10). On the other hand, it is now common for experimental researchers to do what Bronfenbrenner (1976) suggested ten years ago to improve the ecological validity of controlled experiments: talk to the subjects afterwards about what they learned, how they did it, what they thought of the experiment, and so on. So we should try to use quantification, where appropriate, to sharpen our interpretation of qualitative data, and to use what we might call "post-experimental debriefing" of subjects in controlled experiments to find out more about the subjects and how they learned.

The work of Winn and Everett (1979) and McIsaac, Mosley and Story (1984) illustrates one way to do the former. In these studies, factor analysis and multidimensional scaling were applied to subjective ratings of pictures in order to make them more interpretable. This type of study is, of course, "reactionary" in the sense that it still purports to enjoy a measure of experimental control. However, it is not a big step from there to what Howe suggested -- the application of relevant quantitative techniques to data gathered through observation.

To date, I have observed that educational technology researchers have spent far more time telling us why we should be using naturalistic methods than they have doing naturalistic studies. Maybe this is because we are still a little bit afraid that these studies are less likely to be published. Or maybe it betrays our "behavioral" roots and the accompanying belief that all of the behavior that is of interest is amenable to quantification. Be that as it may, there is certainly not the activity in educational technology research as there is in research in teaching and learning in classrooms, for example.

However, I believe that naturalistic inquiry has just as important a role to play in Educational Technology research as it does in other areas. A study by Eastman (in press) serves as a model of the kind of work I have in mind. Eastman gathered data by observing students working with comouters and computer printouts in a language arts class over a period of several months. Her application of the techniques of naturalistic inquiry (see Guba, 1981) to safeguard the validity of the results is exemplary. Her results shed much light on how students think of computers, and how this affects the ways in which they use them. And the type of information she reports could not have been obtained in an experimental study.

In sum, then, I believe that the future trends in methodology in Educational Technology will generally follow the trends in Education as a whole. That is to say, we shall see more non-experimental studies being conducted. However, I feel that our area is probably more reactionary in switching to this type of methodology than other areas in Education because we more than many other scholars have our roots in the observable, quantifiable phenomena so popular with behaviorists. However, we need to develop ways of bringing naturalistic methods to bear on research questions of interest to us, and especially to develop techniques in which qualitative and quantitative methodologies work together rather than against each other in the gathering of data.

Publication of Results.

Once again, so much has been said about how to get research published that I will be brief to avoid redundancy. There are, of course, a few, obvious, general rules. Following these by no means guarantees publication. But failing to follow them does guarantee that the paper will not be published.

First, make sure that you follow the style manual specified in the journal's "Guidelines for authors". Even established scholars often fail to do this, and editors find it most irritating.

Second, make sure that the topic and type of paper are suitable to the journal. You would be surprized if you knew how many manuscripts submitted to ECTJ are about topics that have nothing to do with Educational Technology, however broadly you define it. Also, send scholarly papers to scholarly journals and less scholarly ones to journals that publish non-scholarly articles. I reject many good papers because they are not scholarly. Often these end up in other journals, as they should. But sometimes authors are discouraged by a rejection and do not send their papers to a second, more suitable, journal. This means that a good article that has something to say never does get into press, and we are all the poorer for it.

Make sure that you meet all of the journal's technical requirements. If they ask for four copies, send four copies. If it is to be typed on 8 1/2 by 11 paper, type it that way. Never send little notes to editors in which you explain why you did not follow the technical or stylistic requirements set out by the journal.

The last matter is of more substance, and in a sense recapitulates a lot of what has been said in this paper. Make sure that what you are reporting or writing about will be of interest to the readers of the journal, and will be respected as sound scholarship. This has requirements that concern both the question that you write about and your methodology.

As far as the first point is concerned, you should pick research topics that contributes to current knowldedge, not to something that ceased to be of interest and importance years ago. Clearly, media comparisons are no longer worth publishing, nor are a number of other topics. In order to meet this requirement, you must keep up with what is going on in the field. All of us who supervise graduate students have had to deal with the student who is terribly excited about a particular research question or aspect of theory, not realizing that the question has already been answered, or that the piece of theory belongs to a body of knowledge that is no longer considered to be valid or valuable. It is sometimes hard to persuade such students that their proposed study has no value, and if completed, will contribute nothing and will certainly not be published. So, stay current and read as much as you can.

The same applies to your methodology. Do not use designs that have been superseded by more sophisticated and robust ones. And do not use techniques of analysis that are no longer considered to be acceptable. A frequent mistake, for example, is to use multiple t-tests instead of range tests when a significant difference has been found by analysis of variance with more than two groups. Similarly, do not use parametric tests on ordinal data. That is another frequent flaw in manuscripts that I see. There are a number of these pitfalls, and you should be vigilant and knowledgeable enough to avoid them.

You must also make sure that you have something of consequence to say. Your ideas may be current and the methodology impeccable. But if the results of your empirical study, or the arguments you make in a position paper leave the reader with a "So what?" feeling, then you have not really presented anything that is worth publishing. (After reviewing one such study, an ECTJ reviewer wrote, "What a waste of subjects!" To me, that says it all.)

Finally, a publishable manuscript has to have an internal logic to it. By this, I mean that the hypotheses of an experimental study must be clearly derived from the literature review; that the design must allow one to test the hypotheses; that the techniques used to analyze the data must be appropriate to the design; and that the conclusions must follow from the results. There is nothing worse than hypotheses that appear out of the blue, apparently at the whim of the author, except perhaps for conclusions that are equally unattached to anything that has preceded them. The same spirit should also be present in reports of non-experimental research. The arguments should flow well and the points should follow one another with an obvious logic.

Conclusion

In conclusion let me just remark on the impossibility of speculating with any accuracy about "future trends", whether they be in Physics, Literature or Education. One is tempted to take liberties, as I believe Frank Ogden did recently (Ogden, 1985) when he predicted that, if current trends in "high tech." continue, people will marry robots. I have tried not to take such liberties, but rather reflect upon what I see beginning to happen in research in our field and in kindred areas. I believe that the research questions that I have suggested we need to answer, and the methods we need to develop and use to answer them, do anticipate quite accurately directions in which the field will move. And I hope that the simple suggestions for preparing publishable manuscripts will be of some assistance in getting answers to our research questions into the literature for all to share.

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Learner-Environment Fit:
University Students in a Computer Room

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Abstract

The theory of person-environment fit predicts unhealthy strain caused by a mismatch between factors external to the individual and those that are internal. In the study reported here, the theory of person-environment fit was applied to assess student well-being in a university computer room. A qualitative approach was chosen for this study and a conceptual framework was constructed using Miles and Huberman's technique (1984). A script of questions and probes was prepared from the conceptual framework. Twelve volunteers from a computer literacy course were interviewed. Both objective and subjective data about physical and psychosocial stressors were obtained. Some insights into learner-environment fit are already available, although the results reported here must be regarded as preliminary. Early data cuts suggest educational computing tasks, while less frequent and of shorter duration, may be more intense than pink collar VDT work. Denial or repression may have been a part of the student view in accepting complexity. These defence mechanisms may also indicate a learner role effect which explains student reactions to visual and musculo-skeletal stressors. Better understanding of learner-environment relations is being developed through monitoring interventions such as teaching students how to reduce computer stress.

Learner-Environment Fit:

University Students in a Computer Room

Research on human behavior in work situations has generated a theory describing the relationship of people and their surroundings (Harrison, 1978; Kasl, 1978, p. 33-35; Kulka, 1979). The theory of person-environment fit predicts unhealthy strain caused by a mismatch between factors external to the individual and those that are internal. Stressors may be physical or psychosocial. Each can function objectively or subjectively, operating independently or dependently of the person's perceptions as shown in Figure 1.

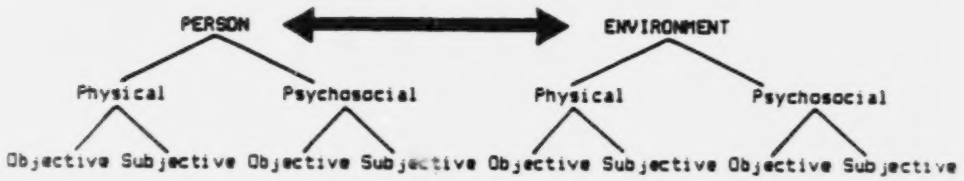

Figure 1. Diagram of person-environment fit components.

The person-environment fit theory is advocated for the study of Visual Display Terminal (VDT) work (National Research Council, 1983, p. 173-193). The goal in that instance is improving the congruence between human characteristics and the computerized workplace. Unhealthy stress is explained as the result of unsuitable environmental conditions created by the rapid implementation of new information technologies. In the study reported here, the theory of person-environment fit was applied to an assessment of student well-being in a university computer room, towards developing better understanding of learner-environment relations in general.

Two separate site analysis studies preceeded the investigation (Yeaman, 1983; 1985). They were rational in nature in that they compared educational computing facilities with a checklist synthesized from standards and guidelines for VDT work. Several physical, objective aspects of the environment appeared inadequate for the students' range of physiological characteristics. The checklist identified lack of adjustment in keyboards and screens; inappropriate chairs, footrests, desk height, leg room and keyboard height; reflective glare from screen and keyboard; and direct glare from bright lights and windows in the field of view. Objectively established psychosocial stressors were the intrusive sounds of voices and printers and the lack of visual privacy. Based on application of that checklist and informal observations of students, recommendations were made for improving microcomputer learning conditions in both settings.

Student impressions had not been assessed and the strength of the student-environment relationship was not known. An obvious difference between academic and workplace computing is the shorter exposure time of learners. Therefore, it was expected that there would be less objective physical and psychosocial stress and the stressors would be assigned weaker subjective perceptions; that the affect of deficient computing environments upon students would be less than upon workers.

Method

Due to the complexity of the issues, a qualitative approach was chosen for this study Strong arguments have been made for this mode of investigative thought in the field of educational communication and technology (Kerr & Taylor, 1985). A reductionist and intrusive measure of stress such as before and after levels of catecholamine and adrenocortical excretion would be limited to only producing data on the objective person physical dimension. Quantitative paper and pencil self-report scales were ruled out due to the importance of sample size in epidemiological surveys on VDT work(Helander, Billingsley & Schurick, 1984).

Following informal observations of several academic computing facilities, a conceptual framework was constructed using Miles and Huberman's technique (1984), see Figure 2. It particularly reflects the learner-environment relationship in delineating components for analysis that are both objective and subjective. The dimensions were corroborated by the Wisconsin-NIOSH industrial study conducted by Sauter, Gottlieb, Jones, Dodson & Rohrer (1983).

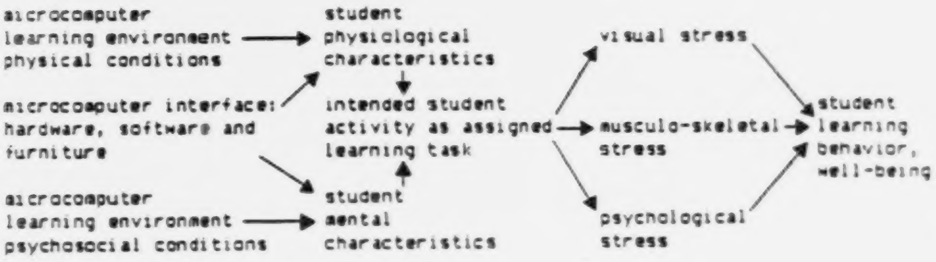
microcomputer learning environment physical conditions
microcomputer interface: hardware, software and furniture
microcomputer learning environment psychosocial conditions
student physiological characteristics
intended student activity as assigned learning task
student mental characteristics
visual stress
musculo-skeletal stress
psychological stress
student learning behavior, well-being

Figure 2. Dimensions of the conceptual framework.

A script of questions and probes was prepared from the conceptual framework. The script was used to conduct structured interviews with university students using the microcomputers in a single computer room. The students reported on the dimensions illustrated in Figure 2.

Because the human factors research literature indicates three predominant symptoms of VDT stress--visual, musculo-skeletal and psychological (National Institute for Occupational Safety and Health, 1981; Sauter et al., 1983)--they were the focal point for evaluation. Both objective and subjective data about stressors were obtained. Objective data included such information as height, weight, corrective eyewear, previous computing experience and time of day each student usually went to the computer room. Subjective data, based on student experiences in the computer room, included such information as feelings of visual and physical discomfort and psychological aspects such as the degree of complexity perceived in completing assignments. Questions about experiences in the computer room preceeded potentially sensitizing questions about feelings of well-being. Regarding the acceptability of verbal reports as data (Nisbett & Wilson, 1977), cautions against confabulation included the acceptance of verbose responses rather than offering the repondents a fixed set of alternative answers (Ericsson & Simon, 1980).

Twelve participants were interviewed. They were all enrolled in a computer literacy course and volunteered to be in the study in exchange for an extra credit incentive offered by their instructor. There were five women and two men from the afternoon section and two women and three men from the evening section of the class. They varied in age from 19 to 35 with 10 students between 19 and 22. None of the interviewees were previously aquainted with the investigator.

The computer room used by the students in this study was originally a small classroom and it had undergone renovation to become a place for academic computing. Briefly, its features were a single door, two rows of suspended fluorescent lights and two unshaded windows. Power strips had been installed and a black workbench erected against three walls. At the time of this investigation, the workbench supported three Apple II+ and two Apple IIe microcomputers, two Okidata dot matrix printers, a Televideo 925, a Lear Siegler ADM-3WU, a DecWriter, a manual typewriter and an electric typewriter.

Individual students working on computer literacy assignments were the primary visitors to the facility and the subjects of this study. Length of use varied from 20 minutes to 8 hours with most students word processing papers or writing programs. They used Magic Window for word processing, Apple BASIC for programming and VisiCalc for spreadsheet exercises. Students from programming classes were the next largest group of people to be found in the room. Other people occasionally present were university clerical workers and professors. Adults and children from the community came in on the evenings and weekends more than any other time. The handful of hacker-like students on the campus preferred to be with the Commodore 64 in the physics lab. That was the place Apple II software was kept and three were employed in checking it out a few hours each day. There was only one hacker-like student frequenting the computer room at the time of the investigation. Unable to take the Pascal class due to a schedule conflict, he taught himself and then proceeded to create a russian typing tutor so he could master the cyrillic keyboard.

Preliminary results

Visual Stress

Objective

Three of the Apple II+ microcomputers had Amdek color monitors which made text appear fuzzy due to horizontal smear. This was particularly apparent when in the 80 column mode. Screen angle was not adjustable. Brightness, contrast and color controls were concealed behind a door immediately below the screen. The fourth Apple II+ had a an older model Heath Zenith green screen with black level and contrast knobs on the front. The image on this screen intermittently rippled and blurred. Sometimes a waving grid pattern appeared too.

The Apple green screens on the Apple IIe microcomputers presented alphanumeric characters considerably sharper. They were adjustable for tilt by pushing on the top or bottom of the screen. Brightness was controlled by a knob on the side. The contrast knob was on the back and not readily accessible.

All the screens reflected the overhead lights and created reflective glare. Two screens reflected extreme glare from the windows: This was particularly strong due to snow outside four months of the year. At night the windows acted as mirrors, reflecting the fluorescent lights. There were no curtains or shades. Keycaps and chrome security locks created highly contrasting reflective glare at every station.

No one was instructed in adjusting the position of screens to reduce reflective glare and increase visual comfort and efficiency. Nor was anyone told about adjusting screen brightness and contrast to suit personal preference. There were no copyholders and drafts of papers and programs were usually laid flat--which induced off-angle reading.

When working with the microcomputers, the students faced the wall at all times: there was nowhere to look away and focus on distant objects for vision relief. Five of the students interviewed wore glasses and another five wore contact lenses. All of those 10 students were myopic. In addition to being nearsighted, two said they had correction for astigmatism. None of the students reported having uncorrected visual problems. None were taking tranquilizers, a medication which can produce visual fatigue symptoms through changes in oculomotor functions.

Subjective

Eight students reported visual discomfort such as red, bloodshot, tired eyes. Four students experienced visual discomfort within the first hour of microcomputer use or less. Three more had eye problems within two hours or less.

Only one student thought the screens too bright or too reflective but other students added qualifying statements: "Unless it is a color screen and that bothers me." "The older models." "Not the screen--sometimes the light coming through the windows will cause glare on the screen."

Ten students never adjusted screens for tilt, contrast or brightness. One adjusted tilt, "To see the bottom of the page." One adjusted contrast, "To make it easier to look at." Nearly all students were vague about the location of any accessible screen controls. There was confusion over there function and sometimes denial of their existence. One student mentioned switching to a 40 character line with bigger letters to make the screen easier to read when using the word processor.

Gender differences became apparent when the students were asked about how reading from the screen felt. Men gave short replies such as "Pretty good." "Okay." and "Very comfortable but my eyes get tired." " Women replied: "Sometimes the words are blurry." "I have to read things twice. After a while they run together--sort of blurry." "After a while it becomes fuzzy to look at." "There are different types of screens and sometimes I have to strain to read the dots." "Would like a bigger screen so I could put more on a line." "If proofing, single spacing is difficult to read. I lose part of the text as I'm scrolling along--it's frustrating."

Analysis

The short time for the onset of eyestrain is anomalous. In comparison, a survey of daily VDT users in a large Swedish insurance company resulted in 55% complaints of optical discomfort (Ericsson Information Systems AB, 1983, p. 63). Contrary to expectations these data suggest educational computing tasks, while less frequent and of shorter duration, may be more intense than the pink collar VDT work which is the usual object of investigation. The unsatisfactory quality of some of the screens for reading text may also be a contributing agent.

Student responses were occasionally self-contradictory. Instead of saying they personally experienced a problem, descriptive evidence was provided which indicated a problem. The male responses were unusually brief in these situations but one succinctly illustrates the paradox: "Very comfortable but my eyes get tired."

Musculo-skeletal stress

Objective

Students varied in weight and in height: from 103 to 220 pounds and from 4 feet 11.5 inches to 6 feet 3 inches. These were accommodated by one size fits all microcomputer stations. Some of the microcomputers were positioned right above the steel legs of the workbench that supports the microcomputers and students sat with restricted knee and leg movement. A general indication of insufficient leg space was the scuff marks around the room where the wall had been kicked by students trying to stretch their legs out. The Apple II home row was 30.5 to 31 inches above the floor. This keyboard height caused many students to sharply bend their elbows and wrists and is higher than any trade union guideline for workstation design, see Ericsson Information Systems AB, (1983, p. 146). The Apple II keyboards were not adjustable or moveable in any way. No footrests were available for shorter students. The chairs had arms attached and were not at all adjustable.

Subjective

On the subjective level, 8 of the 12 reported at least some postural discomfort in either neck, hand, wrist, fingers, shoulders, back or a combination of locations. However most apparently attributed this to what they were doing not, to the furniture. For example, only two people said the chairs were uncomfortable. Complaints of bruised knees were made by one man and by one woman in reference to the steel support legs. Without prompting, three students commented on the lack of copyholders--which they had learned to use in high school typing classes--and said they propped up pages with a book.

Analysis

There was some physical misfit between the objective person and the objective environment because one size does not fit all. This is particularly important to consider when assessing microcomputer learning stations as the equipment severely constrains posture, as opposed to working with print materials that can be moved around. In reference to the steel struts supporting the work surface, the poor positioning of the microcomputers made matters worse. They could not be easily moved as the security devices were attached with permanent glue. However, using those particular microcomputer stations does contain an element of minor hazard. It is revealing that the students' subjective views seldom identified physical aspects of the environment for improvement. With the exception of the students with bruised knees, they took responsibility for any musculo-skeletal discomfort experienced upon themselves.

Psychological Stress

Objective

New technology is often viewed as too complicated and difficult to comprehend. In this situation, the learners were required to master small details to make computing work for them. These fine points were often limitations imposed by the software and hardware and irrelevant to the larger learning intended.

Subjective

During their interviews 11 of the students never directly admitted that the computers and the computing tasks might be too complex. Nevertheless, a poor person-environment fit is likely since nine reported incidents when they could tell that other students were upset or annoyed. Students were unable to make their programs run. They lost termpapers and programs in the microcomputers and were unable to save or retrieve work which took hours to type in. They reacted by muttering, exclaiming out loud, banging a fist on the table and crumpling or tearing up their paper print out.

Analysis

Denial or repression may have been a part of the student view in accepting complexity. These defence mechanisms may also indicate a learner role effect which would aid in explaining the student reactions to visual and musculo-skeletal stressors. Denial or repression are also suggested by the National Research Council (1983, p. 177) to account for a subjective-objective fit relationship "weakened by a person's subjective distortions."

Six students took responsibility for any problems on themselves with statements such as: "If you have the time to put in--basically--no, they're not too complex." "You must take time to get acquainted. You just can't sit down and do it." "I'm not a brain when it comes to computers. It's a basic computing class--could be more complicated." A student moderated his response by identifying complexity brought about by technological transition: "I'm used to Radio Shack computers so I find it hard sometimes."

Only one student said yes, that the computers and computing tasks were too complex. She placed the responsibility outside of herself by identifying subtle differences between operating the Apple IIe and Apple II+ microcomputers and the inconsistency of software commands for performing the same function.

Discussion

Student learning behavior and well-being were evaluated on the basis of three criteria. These were the symptoms of VDT stress usually found in the work place: visual stress, musculo-skeletal stress and psychological stress. Environmental contributors to these forms of computer stress were assessed by two techniques. The first was objective observation such as measuring the height of keyboards above the floor. The second was rational application of established knowledge such as comparing that measurement with ergonomic recommendations in the human factors literature. Relevant information from the personalogical dimension was collected through interviews. For instance, self reports of physical measurements showed the facility was used by people with a wide range of characteristics. Responses to questions and probes regarding specific stress issues and instances were collected. Analysis has begun and the results of several cuts of the data are reported here.

How computer learning experiences are viewed by students is enigmatic but a position is being built. There is real evidence of the three types of computer stress: student computing activities may be far more stressful than the experience of computer workers. Unlike professionals, the students have high pressure to perform, low control over their tasks, less autonomy and less support in terms of efficient facilities. All three areas investigated revealed real problems. Screens with sharply visible letters and numbers were not often available and all screens had reflective glare. The learning stations were cramped like cockpits in military airplanes. The hands on aspect of computing in demanding attention to trivia was an impediment to the more important, conceptual learning intended. Despite providing supporting evidence for each from of computer stress, students were seldom critical. In favoring satisfaction over dissatisfaction, their statements perhaps reflected more what students would prefer to think about their educational experiences.

Personal characteristics cause individuals to reflect person-environment fit differently and so may group characteristics. Workers with more creative, less repetitive VDT jobs and higher socioeconomic status voice less complaints (Smith et al., 1981, p.397). This white collar group aspect might provide more meaningful comparisons when examining university students: a learner role effect. Student perceptions may be muted by their role: perhaps students tend to be more accepting of what they receive becauses instructors are authorities. The learner role may cause students to believe their learning experiences are set up in the best way possible; that situations are permanent and cannot be improved. There is some support in the person-environment fit literature for this. A study of person-environment fit conducted with 2,020 high school students by French, Rodgers & Cobb (1974) has been re-analyzed by Kulka (1976). Poorer fit was reported by girls than boys, which also lends credence to the gender differences suggested here. Kulka also identified a tendency for goodness of fit to increase for older cohorts. University students may extend that and cover up the occurrence of misfit.

Conclusion

Some insights into learner-environment fit are already available, although the results reported here must be regarded as preliminary. They are the consequences of gathering rich, complex data not yet fully analyzed. Better understanding is being developed through ongoing observations and informal questioning of students. Monitoring the effects of intervention such as teaching students how to reduce computer stress are part of this.

A preventive ergonomics approach is taken which has several components, including sensitization to the issues of daily work with computers. These are readily demonstrable as the computer room has not been modified except for conversion to all Apple IIe microcomputer equipment and Appleworks integrated software. Some examples follow: Students are shown how to adjust screens to match contrast and brightness to their personal preference and how to tilt screens to minimize reflective glare. They are encouraged to get up, walk around and engage in stretching exercises and not stay rigid in one seat. Frequent rest breaks are also suggested.

Psychosocial dimensions are handled in a similar way. Caporael identifies two important components in learning to use a computer (1985, p. 187-188): trial and error learning and computing as a social activity. Trial and error learning is reduced by several strategies: Students are encouraged to save their work every 15 minutes at least to avoid accidental loss. Recipe sheets are prepared with instructional design principles to guide beginners through the basic steps of using a word processor, a spreadsheet and a database. New strategies have also been adopted to reinforce the social transfer of information: There are more large screen demonstrations in class time. There are also more orientation labs as part of class. Students are encouraged to work together on class projects in twos or threes. Above all, students are encouraged to take responsibility for their learning upon themselves and practice Ellis' philosophy (1978):

> I feel determined to strive to use whatever power I have to change the unpleasant stresses of life that I can change, to dislike but realistically accept those that I cannot change, and to have the wisdom to know the difference between the two. (p.203).

Ergonomic recommendations for business computing facilities have been applied towards the objective assessment of microcomputer learning environments (Yeaman, 1983, 1985) but subjective dimensions also need to be considered in research on educational computing. Students' reported feelings need to be checked against what they perceive happening to other students and contrasted with objective dimensions of the conceptual model, shown in Figure 2, through direct observation. The application of person-environment fit may be useful in developing guidelines for the improvement of computer learning facilities. Just as computer learning experiences should increase student well-being and learning performance, so should any learning experiences, and further analysis of learner-environment relations may provide a fruitful theory for that interaction.

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CUMULATIVE 1985-1986 AUTHOR INDEX

AUTHOR'S NAME	DESCRIPTOR	YR/PG
ABRAMS, A.	INTERACTIVE VIDEO	86/1
ABRAMS, A.	PHOTOGRAPHY SKILLS	86/1
AEGERTER, R.	LEARNING STYLES	85/750
AEGERTER, R.	PERSUASION	85/750
ALBRIGHT, M.J.	ALGEBRA	85/1
ALBRIGHT, M.J.	INCENTIVE	85/1
ALEAMONI, L.M.	LIBRARY MANAGEMENT	86/252
ALESANDRINI, K.	GRAPHICS	85/18
ALESANDRINI, K.	COURSEWARE	85/18
ALLEN, B.S.	ACQUISITION SKILLS	85/29
ALLEN, B.S.	COMPARISON STRATEGIES	85/29
AMEDEO, D.	TEXT LAYOUT	85/280
ANASTASOFF, J.	COMPUTERS	85/703
ANGLIN, G.J.	PROSE	85/57
ANGLIN, G.J.	ILLUSTRATIONS	85/57
ANGLIN, G.J.	RECALL	86/15
ANGLIN, G.J.	PICTURE EFFECTS	86/15
BAKER, P.	INDIVIDUAL DIFFERENCES	85/146
BAKER, P.	INSTRUCTIONAL STRATEGY	86/65
BAKER, P.	COMPUTER-BASED INSTRUCTION	85/146
BAKER, P.R.	SCREEN DESIGN	86/36
BAKER, P.R.	COMPUTER GRAPHICS	86/36
BAKER. P.	PACING	86/65
BECKER, A.	RESEARCH	85/72
BECKER, A.	THEORY	85/72
BELLAND, J.	ENCODING	85/87
BELLAND, J.	COMPUTER-BASED INSTRUCTION	85/146
BELLAND, J.	INSTRUCTIONAL STRATEGY	86/177
BELLAND, J.	INDIVIDUAL DIFFERENCES	85/146
BELLAND, J.	INSTRUCTIONAL DESIGN	85/87
BELLAND, J.	PACING	86/65
BELLAND, J.C.	SCREEN DESIGN	86/36
BELLAND, J.C.	COMPUTER GRAPHICS	86/36
BERRY, T.	LEARNING STYLES	85/750
BERRY, T.	PERSUASION	85/750
BOWIE, M.M.	LEARNING STYLES	86/49
BOWIE, M.M.	FILM	86/49
BRATTON, B.	GRADUATE EDUCATION	86/421
BRATTON, B.	CURRICULUM CHANGES	86/421
CAMBRE, M.A.	SCREEN DESIGN	86/36
CAMBRE, M.A.	COMPUTER GRAPHICS	86/36
CANELOS, J.	INDIVIDUAL DIFFERENCES	85/146
CANELOS, J.	PACING	86/65
CANELOS, J.	ENCODING	85/87
CANELOS, J.	COMPUTER-BASED INSTRUCTION	85/146
CANELOS, J.	LEARNING STRATEGIES	85/848
CANELOS, J.	INSTRUCTIONAL DESIGN	85/87
CANELOS, J.	LEARNING STRATEGIES	85/848
CANELOS, J.	INSTRUCTIONAL STRATEGY	86/65
CANELOS, J.	NOTETAKING	85/848
CARL, D.L.	ATTITUDES	86/85
CARL, D.L.	COMPUTERS	86/85
CARL, R.R.	ATTITUDES	86/85

AUTHOR'S NAME	DESCRIPTOR	YR/PG
CARL, R.R.	COMPUTERS	86/85
CHUTE, A.G.	TELETRAINING	86/106
CHUTE, A.G.	MEDIA UTILIZATION	86/106
COOK, S.	PERSUASION	85/750
COOK, S.	LEARNING STYLES	85/750
DALTON, D. W.	ATTITUDE	86/119
DALTON, D.W.	WRITING SKILLS	86/166
DALTON, D.W.	EFFICACY OF LOGO	86/119
DALTON, D.W.	COMPUTER-BASED REINFORCEMENT	85/101
DALTON, D.W.	REINFORCEMENT	85/101
DALTON, D.W.	WORD PROCESSING	86/166
DALTON, D.W.	ATTITUDE	86/153
DALTON, D.W.	MEDIA UTILIZATION	86/153
DEGRAFF, J.	TELEVISION	85/125
DEGRAFF, J.	FILM THEORY	85/125
DUDT, K.P.	TELEVISION	86/185
DUDT, K.P.	AFFILIATED CABLE TELEVISION	86/195
DUDT, K.P.	AFFILIATED CABLE TELEVISION	86/185
DUDT, K.P.	TELEVISION	86/195
DWYER, F.	PACING	86/65
DWYER, F.	NOTETAKING	85/848
DWYER, F.	LEARNING STRATEGIES	85/848
DWYER, F.	COMPUTER-BASED INSTRUCTION	85/146
DWYER, F.	INDIVIDUAL DIFFERENCES	85/146
DWYER, F.	ENCODING	85/87
DWYER, F.	INSTRUCTIONAL DESIGN	85/87
DWYER, F.	INSTRUCTIONAL STRATEGY	86/65
EVANS, L.J.	MEDIA SELECTION	86/210
FELT, S.B.	GRADUATE EDUCATION	86/302
FELT, S.B.	MANAGEMENT	86/302
FORMAN, G.E.	VIDEO	85/164
FORMAN, G.E.	COGNITION	85/164
FOSNOT, C.T.	VIDEO	85/164
FOSNOT, C.T.	COGNITION	85/164
FRENCH, M.	INSTRUCTION	85/220
FRENCH, M.	INSTRUCTIONAL STRATEGIES	85/193
FRENCH, M.	ANALYTIC ABILITY	85/193
FRENCH, M.	RESEARCH	85/220
GAGNON, R.	INSTRUCTIONAL TECHNOLOGY	85/232
GAMSKY, D.	TEACHER SOCIALIZATION	85/318
GAMSKY, D.	COMPUTERS	85/318
GARDNER, C.H.	ELECTRONIC MAIL	86/220
GARHART, C.	COMPUTER-BASED INSTRUCTION	86/230
GARHART, C.	COMPUTER-BASED INSTRUCTION	86/336
GARHART, C.	COMPUTER-BASED INSTRUCTION	86/336
GARHART,C.	COGNITIVE MONITORING	86/230
GJERDE, C.L.	CURRICULUM CHANGES	86/421
GJERDE, C.L.	GRADUATE EDUCATION	86/421
GOETZFRIED, L.	MATHEMATICS	85/252
GOETZFRIED, L.	COMPUTER-ASSISTED INSTRUCTION	85/252
GOTHBERG, H.M.	TIME MANAGEMENT	86/252
GOTHBERG, H.M.	LIBRARY MANAGEMENT	86/252
GRABINGER, R. S.	COMPUTER-GENERATED TEXT	86/271

AUTHOR'S NAME	DESCRIPTOR	YR/PG
GRABINGER, R.S.	TEXT LAYOUT	85/280
GRABINGER, R.S.	TEXT FORMAT	86/271
GREATHOUSE, S.	COMPUTERS	86/85
GREATHOUSE, S.	ATTITUDES	86/85
GRIBBLE, M.	TEACHER SOCIALIZATION	85/318
GRIBBLE, M.	COMPUTERS	85/318
HALES, R.L.	MANAGEMENT	86/302
HALES. R.H.	GRADUATE EDUCATION	86/302
HANCLOSKY, W. V.	TASK ANALYSIS	86/313
HANCLOSKY, W.V.	ADVANCE ORGANIZER	86/313
HANNAFIN, M.	COGNITIVE MONITORING	86/230
HANNAFIN, M.	COMPUTER-BASED INSTRUCTION	86/336
HANNAFIN, M.	MATHEMATICS	85/252
HANNAFIN, M.	COMPUTER-ASSISTED INSTRUCTION	85/252
HANNAFIN, M.	COMPUTER-BASED INSTRUCTION	86/230
HANNAFIN, M.J.	ATTITUDE	86/153
HANNAFIN, M.J.	MEDIA UTILIZATION	86/153
HANNAFIN, M.J.	COMPUTER-BASED REINFORCEMENT	85/101
HANNAFIN, M.J.	ACHIEVEMENT	85/101
HART, R. A.	MEDIA ATTRIBUTES	86/358
HART, R.A.	SYNTACTIC PLACEMENT	85/332
HART, R.A.	CONCEPT LEARNING	85/332
HART. R.A.	VISUALIZATION	86/358
HO, M.L.	CURRICULUM DIRECTORS	85/372
HO, M.L.	TEACHING INSTITUTIONS	85/372
HO, M.L.	COLLECTION SCALES	86/390
HO, M.L.	MAPPING	86/390
HORTIN, J.A.	MEDIA LIBRARIES	86/410
HORTIN, J.A.	PUZZLE SOLVING	85/386
HORTIN, J.A.	IMAGERY	85/386
HORTIN, J.A.	TEACHER/PRINCIPAL ATTITUDES	86/410
HOUSE, J.D.	GRADUATE EDUCATION	86/421
HOUSE, J.D.	CURRICULUM CHANGES	86/421
HURT, J.A.	ILLUSTRATIONS	85/392
HURT, J.A.	PROSE	85/392
JONASSEN D.H.	PERCEPTUAL/COGNITIVE TASK	86/451
JONASSEN, D. H.	SEARCH TASK	86/469
JONASSEN, D.H.	LIST VS. FLOW CHART	86/469
JONASSEN, D.H.	STATE ANXIETY	86/461
JONASSEN, D.H.	COMPUTERPHOBIA	86/461
JONASSEN, D.H.	COMPUTER DISPLAY	86/451
JONES, P.E.	INSTRUCTIONAL TELEVISION	86/478
JONES, P.E.	RESEARCH	86/478
KING, J.W.	CASE STUDY METHODOLOGY	85/418
KING, J.W.	COMMUNICATION PROGRAMS	85/418
KLOOK, T	PERSUASION	85/750
KLOOK, T	LEARNING STYLES	85/750
KOETTING, J.R.	TEACHING ANALYSIS	85/437
KOETTING, J.R.	VIDEO	85/437
LAMBERSKI, R.J.	NONCOMMERCIAL FM RADIO	86/505
LAMBERSKI, R.J.	TELEVISION	86/195
LAMBERSKI, R.J.	AFFILIATED CABLE TELEVISION	86/195
LAMBERSKI, R.J.	RADIO	86/505

AUTHOR'S NAME	DESCRIPTOR	YR/PG
LAMBERSKI, R.J.	TELEVISION	86/185
LAMBERSKI, R.J.	AFFILIATED CABLE TELEVISION	86/185
LAMBERSKI. R.J.	RADIO	86/490
LAMBERSKI. R.J.	NONCOMMERCIAL FM RADIO	86/490
LEIDMAN, M.B.	RADIO	86/490
LEIDMAN, M.B.	NONCOMMERCIAL FM RADIO	86/505
LEIDMAN, M.B.	RADIO	86/505
LEIDMAN,M.B.	NONCOMMERCIAL FM RADIO	86/490
LOERTSCHER, D.	MAPPING	85/390
LOERTSHCER. D.	COLLECTION SCALES	86/390
LYNCH, B.E.	SPATIAL RELATIONSHIPS	86/521
LYNCH, B.E.	FILMIC CODING	86/521
LYNESS, A.L.	INTERACTIVE VIDEO	85/462
MATTHIAS, M.	COMPUTERS	85/703
MOLINA, R.R.	RESEARCH	85/479
MOLINA, R.R.	SPATIAL VISUALIZATION	85/479
MOORE, D.M.	FIELD DEPENDENCE/INDEPENDENCE	85/485
MOORE, D.M.	IMAGERY	85/485
MORIN, A.	INSTRUCTIONAL TECHNOLOGY	85/499
MORIN, A.	THEORY	85/499
MORRISON, G.R.	COMPUTER-MANAGED INSTRUCTION	86/530
MORRISON, G.R.	REGRESSION MODEL	86/530
MOSELY, M.L.	COMPUTERS	86/620
MOSELY. M.L.	MOTIVATION	86/620
MUFFOLETTO, R.	TEACHER SOCIALIZATION	85/318
MUFFOLETTO, R.	COMPUTERS	85/318
NICHOLS, R.	NOTETAKING	85/848
NICHOLS, R.	LEARNING STRATEGIES	85/848
NISHIKAWA, S.S.	FEEDBACK	85/530
OLSON, J.S.	SPEECH	85/558
OLSON, J.S.	TECHNICAL PRESENTATIONS	85/558
PEARSON, M.	LIST VS. FLOW CHART	86/469
PEARSON, M.	SEARCH TASK	86/469
PHILLIPS, T.L.	COMPUTER-BASED INSTRUCTION	86/336
RAGAN, T.J.	INSTRUCTIONAL DESIGN	86/542
RAGAN. T.J.	CAI STRATEGIES	86/542
RANDALL, J.P.	EVALUATION	86/552
RANDALL, J.P.	MEDIA SERVICES	86/552
REHN, R.A.	DOGMATISM	85/557
REHN, R.A.	INSTRUCTIONAL METHODS	85/557
RIEBER, L. P.	PROBLEM SOLVING	86/562
RIEBER, L.P.	EFFICACY OF LOGO	86/562
RIEBER, L.P.	COMPUTER-BASED INSTRUCTION	86/336
RIGGS, D.E.	LIBRARY MANAGEMENT	86/252
RIGGS, D.E.	TIME MANAGEMENT	86/252
ROBINSON, R.S.	INTERACTIVE TELEVISION	85/623
ROBINSON, R.S.	INTERACTIVE CABLE TELEVISION	86/598
ROSS, S.M.	COMPUTER-MANAGED INSTRUCTION	86/530
ROSS, S.M.	REGRESSION MODEL	86/530
ROSSETT, A.	INSTRUCTIONAL DESIGN	85/612
SALCEDO, A.M.	INSTRUCTIONAL TELEVISION	85/650
SALISBURY, D.F.	COMPUTERS	85/663
SALISBURY, D.F.	DRILL AND PRACTICE	85/663

AUTHOR'S NAME	DESCRIPTOR	YR/PG
SEIDMAN, S.A.	TEACHER BURNOUT	85/678
SEIDMAN, S.A.	MEDIA UTILIZATION	85/678
SEIDNER, C.J.	COMPUTER-BASED INSTRUCTION	85/889
SEIDNER, C.J.	TASK PERFORMANCE	85/889
SEYMOUR, S.L.	COMPUTERS	86/620
SEYMOUR, S.L.	MOTIVATION	86/620
SHAW, S.	COMPUTERS	85/703
SHROCK, S.A.	COMPUTERS	85/703
SILVERSTEIN, M.A.	VIDEODISC SYSTEM	85/717
SILVERSTEIN, M.A.	SOCIAL INTERACTION	85/717
SIMONSON, M. R.	SUBLIMINAL MESSAGES	86/763
SIMONSON, M.R.	LEARNING STYLES	85/750
SIMONSON, M.R.	PERSUASION	86/763
SIMONSON, M.R.	PERSUASION	85/750
SMITH, P.	SIMULATION	86/656
SMITH, P.	COMPUTER-BASED INSTRUCTION	86/656
SMITH, P.L.	PROCESSING	86/635
SMITH, P.L.	CUEING	86/635
SMITH, P.L.	TEXT DESIGN	85/783
STACY, N.O.	COMPUTERS	86/620
STEVENSON, R.B.	COMPUTER LITERACY	85/797
STEVENSON, R.B.	EMPOWERED LEARNING	85/797
STONE, R.	PERSUASION	85/750
STONE, R.	LEARNING STYLES	85/750
STORM, S.R.	TELEVISION	85/813
STORM, S.R.	CHILDREN	85/813
STORY, N.O.	MOTIVATION	86/620
SULLIVAN, H.J.	MOTIVATION	86/620
SULLIVAN, H.J.	COMPUTERS	86/620
TAYLOR, W.	ENCODING	85/87
TAYLOR, W.	INSTRUCTIONAL STRATEGY	86/65
TAYLOR, W.	INSTRUCTIONAL DESIGN	85/87
TAYLOR, W.	NOTETAKING	85/848
TAYLOR, W.	PACING	86/65
TAYLOR, W.	INDIVIDUAL DIFFERENCES	85/146
TAYLOR, W.	LEARNING STRATEGIES	85/848
TAYLOR, W.	COMPUTER-BASED INSTRUCTION	85/146
TIENE, D.	TELEVISION	86/745
TIENE, D.	INSTRUCTIONAL TELEVISOIN	86/721
TIENE, D.	PUBLIC TELEVISION	86/ 721
TILLMAN, M.H.	ELECTRONIC MAIL	86/220
TORARDI, M.M.	COMPUTER LITERACY ASSESSMENT	85/860
TOUGER, H.E.	TASK PERFORMANCE	85/889
TOUGER, H.E.	COMPUTER-BASED INSTRUCTION	85/889
TREIMER, M.	PERSUASION	86/763
TREIMER, M.	SUBLIMINAL MESSAGES	86/763
VENSEL, C.	COMPUTERS	85/703
WATSON, J.F.	WRITING SKILLS	86/166
WATSON, J.F.	WORD PROCESSING	86/166
WEDMAN, J. F.	COMPUTER INSERVICE	86/782
WEDMAN. J.F.	INSERVICE DESIGN	86/782
WELLIVER, P. W.	GRADUATE STUDENTS	86/797
WEST, P.C.	INTERACTIVE CABLE TELEVISION	86/598

AUTHOR'S NAME	DESCRIPTOR	YR/PG
WILSON, B.G.	SYNTHESIZING STRATEGIES	85/901
WILSON, B.G.	COMPUTER-BASED INSTRUCTION	85/901
WINN, W.	RESEARCH TRENDS	86/801
YEAMAN, A.R.J.	RESEARCH	85/921
YEAMAN, A.R.J.	ELECTRONIC BOOKS	85/921
YEAMEN, A. R.	PERSON-ENVIRONMENT FIT	86/833

CUMULATIVE 1979-1984 AUTHOR INDEX

AUTHOR'S NAME	DESCRIPTOR	YR/PAGE
ACEVEDO, C.	PICTORIAL ELABORATION	80/1
ACEVEDO, C.	BILINGUAL LEARNERS	80/1
ACEVEDO, C.	COGNITIVE EFFECT	80/1
ALTER, M.	SPECIAL EDUCATION	82/105
ALTER, M.	EVALUATION	82/105
ALTER, M.	INSTRUCTIONAL SYSTEMS	82/105
ALTSCHULD, J.	VISUALIZED INSTRUCTION	82/183
ALTSCHULD, J.	LEARNING	82/183
ALTSCHULD, J.	ENCODING	83/125
ALTSCHULD, J.	INFORMATION CUEING	83/125
ANDERSON, C.	COMMUNICATION	80/35
ANDERSON, C.	MEDIA COMPETENCY	80/35
ANGERT, J.	PICTORIAL RESEARCH	80/125
ANGERT, J.	META-ANALYTIC	80/125
ANGERT, J.F.	RESEARCH	79/1
ANGERT, J.F.	RESEARCH	82/144
ANGLIN, G.J.	APTITUDE	81/1
ANGLIN, G.J.	ATI	81/1
ANGLIN, J.B.	APTITUDE	81/1
ANGLIN, J.B.	ATI	81/1
ARNOLD, T.C.	BEHAVIORAL OBJECTIVES	82/15
ARNOLD, T.C.	INSTRUCTIONAL EFFECT	82/15
ARNOLD, T.C.	STIMULUS-EXPLICITNESS	82/15
ATANG, C.I.	COGNITIVE STYLES	84/1
ATANG, C.I.	FIELD DEPENDENCE/INDEPENDENCE	84/1
ATANG, C.I.	TIME FACTOR	84/1
BARON, L.J.	TELEVISION	79/158
BARON, L.J.	CHILDREN	79/158
BARON. L.J.	EYE MOVEMENT	79/158
BECKER, A.	VISUAL LITERACY	80/55
BECKER, A.	GESTALT APPROACH	80/55
BECKER, A.D.	CRITICAL DIALOGUE	82/469
BECKER, A.D.	TELEVISION	81/23
BECKER, A.D.	VISUALIZATION	82/469
BECKWITH, D.	RESEARCH	84/17
BECKWITH, D.	LEARNERS	83/1
BECKWITH, D.	LEARNER CHARACTERISTICS	84/17
BECKWITH, D.	INSTRUCTIONAL DEVELOPMENT	83/1
BEDNAR, A.K.	COGNITIVE STYLE	79/303
BEDNAR, A.K.	COGNITIVE APTITUDE	79/303
BEDNAR, A.K.	ACADEMIC SUCCESS	79/303
BERBEKAR, R.	BRAIN RESEARCH	83/736
BERBEKAR, R.	INSTRUCTIONAL DESIGN	83/736
BERRY, L.H.	COGNITIVE STYLE	84/34
BERRY, L.H.	RESEARCH	82/483
BERRY, L.H.	RATE-MODIFIED SPEECH	82/483
BERRY, L.H.	AUDITORY LEARNING	83/517
BERRY, L.H.	COGNITIVE STYLE	83/517
BERRY, L.H.	VISUALIZATION	82/21
BERRY, L.H.	PICTORIAL RESEARCH	84/34
BERRY, L.H.	COLOR	82/21
BERRY, L.H.	CULTURAL VARIATIONS	83/46
BERRY, L.H.	COLOR	83/46
BERRY, L.H.	PICTORIAL RESEARCH	83/46
BERRY, L.H.	TIME-COMPRESSED SPEECH	83/517
BERRY, T.	PERSUASION	83/58
BERRY, T.	FEAR	83/58
BOVY, R.C.	COGNITIVE LEARNING	81/35

AUTHOR'S NAME	DESCRIPTOR	YR/PAGE
BOVY, R.C.	INSTRUCTIONAL DESIGN	81/35
BOWIE, M.M	DEMOGRAPHIC	83/74
BOWIE, M.M.	PERFORMANCE	83/74
BOWIE, M.M.	MEDIA SPECIALIST	83/74
BRANSON, R.K.	INSTRUCTIONAL DESIGN	79/602
BRATTON, B.	BEHAVIORAL OBJECTIVES	80/190
BRAVERMAN, M.	TELEVISION	81/78
BRAVERMAN, M.	ATTENTION	81/78
BRIDGES, N.	PROGRAMMED INSTRUCTION	82/154
BRIDGES, N.	AURAL PERCEPTION	82/154
BRIDGES, N.	MUSIC	82/154
BRODY, P.	PICTORIAL RESEARCH	80/70
BRODY, P.	INSTRUCTIONAL TEXTS	80/70
BRODY, P.J.	COMPREHENSION	79/351
BRODY, P.J.	FUNCTIONS	83/96
BRODY, P.J.	PICTORIAL RESEARCH	84/44
BRODY, P.J.	PICTORIAL RESEARCH	83/96
BRODY, P.J.	PICTORIAL RESEARCH	79/351
BRODY, P.J.	NATURALISTIC INQUIRY	84/44
BRODY, P.J.	INSTRUCTIONAL METHODS	84/44
BROOKE, M.L.	SYMBOL LEARNING	8/85
BROOKE, M.L.	VISUAL LEARNING	81/85
BRUCE, K.L.	COMPUTERS	84/331
BRUCE, K.L.	INSTRUCTIONAL MANAGEMENT	84/331
BRUCE, K.L.	COGNITIVE STYLE	84/331
BURNELL, S.	MEDIA SPECIALIST	79/191
BURNELL, S.	PRINCIPALS	79/191
BURNELL, S.	PERCEPTIONS	79/191
BURROWAY, R.L.	COGNITIVE STYLE	84/56
BURROWAY, R.L.	COMPUTERS	84/56
BURROWAY, R.L.	TESTING	84/56
BURTON, J.	MATCHING LEARNING THEORY	80/630
BURTON, J.	INSTRUCTIONAL TECHNOLOGY	80/630
BURTON, J.	EVALUATION	80/630
CANELOS, J.	RESEARCH	82/27
CANELOS, J.	RETENTION	83/125
CANELOS, J.	FIELD DEPENDENCE	81/88
CANELOS, J.	BEHAVIORAL OBJECTIVES	80/85
CANELOS, J.	VISUALIZED INSTRUCTION	82/183
CANELOS, J.	INFORMATION PROCESSING	81/88
CANELOS, J.	CUEING	84/72
CANELOS, J.	THEORY	82/27
CANELOS, J.	MEDIATED INSTRUCTION	84/72
CANELOS, J.	NETWORKING	81/88
CANELOS, J.	RESEARCH	82/163
CANELOS, J.	FIELD DEPENDENCE/INDEPENDENCE	80/85
CANELOS, J.	ENCODING	83/125
CANELOS, J.	LEARNING	84/72
CANELOS, J.	LEARNING	82/183
CANELOS, J.	VISUALIZATION	80/85
CANELOS, J.	DWYER RESEARCH	82/27
CANELOS, J.	INFORMATION CUEING	83/125
CAREY, J.O.	MEMORY STRATEGIES	81/166
CAREY, J.O.	ABSTRACT LEARNING	81/105
CAREY, J.O.	CONCRETE LEARNING	81/105
CAREY, L.M.	SELF EVALUATION	79/212
CAREY, L.M.	FEEDBACK	79/212
CARL, D.L.	ADMINISTRATORS	84/99
CARL, D.L.	COMPUTERS	84/99

AUTHOR'S NAME	DESCRIPTOR	YR/PAGE
CARL, D.L.	PERCEPTIONS	84/99
CARRIER, C.	TEACHER THEORIES	82/197
CARRIER, C.	TEACHER PRACTICES	82/197
CHEZIK, M.A.	PROSE MATERIAL	82/33
CHEZIK, M.A.	LEARNING	82/33
CHISWELL, J.	EMPIRICAL RESEARCH	80/98
CHISWELL, J.	IMAGERY	80/98
CHUTE, A.	TELECONFERENCE	82/235
CHUTE, A.G.	TELECONFERENCE	83/283
CLARK, F.	META-ANALYTIC	80/125
CLARK, F.	PICTORIAL RESEARCH	80/125
CLARK, F.E.	RESEARCH	79/1
CLARK, F.E.	RESEARCH	82/144
COLE, D.D.	COMPUTERS	83/295
COOK, S.	INSTRUCTIONAL MEDIA	82/439
COOK, S.	FIELD DEPENDENCE	82/439
COOK, S.	ATTITUDES	82/439
CROSSMAN, J.	NONVERBAL COMMUNICATION	83/776
CROSSMAN, J.	AMERICANESE	83/776
DAVIDSON, G.V.	FIELD DEPENDENCE/INDEPENDENCE	83/156
DAVIDSON, G.V.	DENTAL HYGIENE	83/156
DE MELO, H.	INSTRUCTIONAL VARIABLES	83/175
DE MELO, H.	INSTRUCTIONAL EFFECT	83/203
DE MELO, H.	VISUAL TESTING	83/175
DE MELO, H.	INTERACTIONS	83/175
DE MELO, H.	VISUALIZED INSTRUCTION	83/203
DE MELO, H.T.	INSTRUCTIONAL EFFECT	82/40
DEMELO, H.T.	TESTING	82/40
DEMELO, H.T.	ENCODING	81/120
DEMELO, H.T.	VISUAL TESTING	81/120
DIMOND, P.	RESEARCH	84/118
DIMOND, P.	PUBLICATIONS	84/118
DIONNE, J.P.	PSYCHOEPISTEMOLOGY	81/486
DIONNE, J.P.	HEMISPHERICITY	81/486
DODGE, B.	INSTRUCTIONAL DESIGN	80/166
DODGE, B.	LEARNER INTEREST	80/166
DRESANG, E.T.	MAINSTREAMING	82/256
DRESANG, E.T.	MEDIA UTILIZATION	82/256
DRESANG, E.T.	ATTITUDES	82/256
DUCHASTEL, P.	ILLUSTRATIONS	81/137
DUNN, W.	BEHAVIORAL OBJECTIVES	80/190
DWYER, F.	CUEING	84/72
DWYER, F.	MEDIATED INSTRUCTION	84/72
DWYER, F.	LEARNING	84/72
DWYER, F.M.	VISUAL CUEING	82/54
DWYER, F.M.	TESTING	82/40
DWYER, F.M.	INTERACTIONS	83/175
DWYER, F.M.	BEHAVIORAL OBJECTIVES	82/54
DWYER, F.M.	ENCODING	81/120
DWYER, F.M.	VISUALIZATION	82/60
DWYER, F.M.	INSTRUCTIONAL EFFECT	82/60
DWYER, F.M.	INSTRUCTIONAL EFFECT	82/40
DWYER, F.M.	INSTRUCTIONAL VARIABLES	83/175
DWYER, F.M.	LEARNING	82/33
DWYER, F.M.	RETRIEVAL STRATEGIES	82/69
DWYER, F.M.	ACHIEVEMENT	82/54
DWYER, F.M.	BEHAVIORAL OBJECTIVES	82/15
DWYER, F.M.	SYSTEMATIC EVALUATION	82/2
DWYER, F.M.	COGNITIVE LEARNING	82/69

AUTHOR'S NAME	DESCRIPTOR	YR/PAGE
DWYER, F.M.	INSTRUCTIONAL EFFECT	82/15
DWYER, F.M.	VISUALIZED INSTRUCTION	83/203
DWYER, F.M.	PROSE MATERIAL	82/33
DWYER, F.M.	VISUAL TESTING	83/175
DWYER, F.M.	INSTRUCTIONAL EFFECT	83/203
DWYER, F.M.	VISUAL TESTING	81/120
DWYER, F.M.	STIMULUS-EXPLICITNESS	82/15
DWYER, F.M.	RESEARCH	79/20
EHRLICH, L.R.	COMPUTER SIMULATION	79/631
EL-GAZZAR, A.I.	COLOR	84/127
EL-GAZZAR, A.I.	MEMORY	84/127
EL-GAZZAR, A.I.	PICTORIAL RESEARCH	84/127
ERNEST, P.S.	EDUCATIONAL TECHNOLOGY	82/278
ERNEST, P.S.	TEACHER COMPETENCE	82/278
ERNEST, P.S.	ASSESSMENT	82/278
ESQUE, T.	INDUSTRY	84/394
ESQUE, T.	TASK ANALYSIS	83/394
FILAN, G.L.	RESEARCH	79/28
FILAN, G.L.	BEHAVIORAL OBJECTIVES	79/28
FILAN, G.L.	THEORY	79/28
FLEMING, M.	LEARNER CHARACTERISTICS	80/201
FLEMING, M.	DESIGN	84/163
FLEMING, M.	MEDIA TECHNIQUES	80/201
FLEMING, M.	LEARNERS	84/163
FLEMING, M.	VISUALIZATION	84/163
FLEMING, M.	INSTRUCTIONAL MEDIA	80/201
FLEMING, M.L.	BEHAVIORAL SCIENCE	79/73
FLEMING, M.L.	RESEARCH	79/73
FRENCH, M.	VISUALIZATION	83/263
FRENCH, M.	MEDIA TECHNIQUES	84/178
FRENCH, M.	APTITUDE	83/226
FRENCH, M.	INSTRUCTION	84/178
FRENCH, M.	APTITUDE	84/178
FRENCH, M.	VISUAL LEARNING	83/226
FRENCH, M.	SUPPLANTATION APPROACH	83/263
GENTRY, C.	EVALUATION	81/147
GENTRY, C.	INSTRUCTIONAL DESIGN	81/147
GERLACH, V.	ALGORITHMIC INSTRUCTION	80/217
GERLACH, V.	ALGORITHMIC INSTRUCTION	80/440
GERLACH, V.	PERCEPTUAL-MOTOR	80/217
GERLACH, V.S.	BEHAVIORAL OBJECTIVES	79/241
GERLACH, V.S.	BEHAVIORAL OBJECTIVES	79/28
GERLACH, V.S.	RESEARCH	79/28
GERLACH, V.S.	THEORY	79/28
GILBERT, R.M.	MEDIA UTILIZATION	82/311
GILBERT, R.M.	TEACHING	82/311
GLEASON, J.J.	ETHNOGRAPHY	81/670
GOLDSTEIN, M.	SPECIAL EDUCATION	82/105
GOLDSTEIN, M.	INSTRUCTIONAL SYSTEMS	82/105
GOLDSTEIN, M.	EVALUATION	82/105
GRABOWSKI, B.	INSTRUCTIONAL DESIGN	82/46
GRABOWSKI, B.	INTEGRATED LEARNING SYSTEM	82/46
GRABOWSKI, B.	PRESERVICE TEACHERS	80/220
GRABOWSKI, B.	ATTITUDES	80/220
GRABOWSKI, B.	PERSUASION	80/220
GRAY, J.	MEDIA PROGRAM	82/360
GRAY, J.	ATTITUDES	82/360
GUZMAN-MALDONADO, A.A.	ETHNOGRAPHY	81/670
HAAS, N.	COMPUTER-ASSISTED INSTRUCTION	84/402

AUTHOR'S NAME	DESCRIPTOR	YR/PAGE
HAAS, N.	MOTIVATION	84/402
HANCOCK, B.W.	TELECONFERENCE	83/283
HANCOCK, B.W.	TELECONFERENCE	82/235
HANNAFIN, M.	FEEDBACK	80/244
HANNAFIN, M.	MATHEMATICS	80/244
HANNAFIN, M.J.	CHILDREN	82/338
HANNAFIN, M.J.	PICTORIAL RESEARCH	84/220
HANNAFIN, M.J.	COMPUTERS	83/295
HANNAFIN, M.J.	AURAL INSTRUCTION	83/533
HANNAFIN, M.J.	LEARNING STRATEGIES	82/325
HANNAFIN, M.J.	PROSE	84/220
HANNAFIN, M.J.	MEMORY STRATEGIES	81/166
HANNAFIN, M.J.	VIDEOTAPED INSTRUCTION	83/533
HANNAFIN, M.J.	ANALYSIS	82/325
HANNAFIN, M.J.	RETENTION	83/533
HANNIFAN, M.J.	LEARNING STRATEGIES	82/338
HANNIFIN, M.J.	CONCRETE LEARNING	81/105
HANNIFIN, M.J.	ABSTRACT LEARNING	81/105
HARRISON, R.	BILINGUAL EDUCATION	80/262
HARRISON, R.	VISUAL PERCEPTION	80/262
HARRISON, R.T.	NONVERBAL COMMUNICATION	83/776
HARRISON, R.T.	AMERICANESE	83/776
HEDBERG, J.G.	CROSS CULTURAL ANALYSIS	79/244
HEDBERG, J.G.	HIGHER EDUCATION	79/244
HEDBERG, J.G.	INSTRUCTIONAL INNOVATION	79/244
HENNIGAN, T.L.	TEACHING	82/311
HENNIGAN, T.L.	MEDIA UTILIZATION	82/311
HINES, S.J.	VISUALIZATION	82/352
HINES, S.J.	BRAIN WAVES	82/352
HODGES, Y.A.	ATTITUDES	82/360
HODGES, Y.A.	MEDIA PROGRAM	82/360
HOELSCHER, S.	COMPUTERS	84/99
HOELSCHER, S.	PERCEPTIONS	84/99
HOELSCHER, S.	ADMINISTRATORS	84/99
HOLLIDAY, W.G.	DIAGRAMS	81/715
HOLLIDAY, W.W.	LEARNING	81/715
HORTIN, J.A.	PROBLEM SOLVING	84/240
HORTIN, J.A.	VISUALIZATION	82/376
HORTIN, J.A.	THEORY	82/376
HORTIN, J.A.	IMAGERY	84/240
HORTON, J.A.	VISUALIZATION	83/318
HORTON, J.A.	RESEARCH	79/140
HORTON, J.A.	EDUCATIONAL TECHNOLOGY	83/318
HORTON, J.A.	AV COMMUNICATION REVIEW	79/140
HUGHS, L.H.	COMPREHENSION	84/499
HUGHS, L.H.	PICTORIAL RESEARCH	84/499
HUGHS, L.H.	TIME-COMPRESSED SPEECH	84/499
ISRAELITE, L.	SELF EVALUATION	79/212
ISRAELITE, L.	FEEDBACK	79/212
JACKSON, A.	BRAIN RESEARCH	83/736
JACKSON, A.	INSTRUCTIONAL DESIGN	83/736
JACOBS, R.L.	INTERACTIONS	82/396
JACOBS, R.L.	PSI	82/396
JACOBS, R.L.	COGNITIVE STYLE	82/396
JENNINGS, T.	ACHIEVEMENT	82/54
JENNINGS, T.	ACHIEVEMENT	80/280
JENNINGS, T.	VISUAL CUEING	80/280
JENNINGS, T.	VISUAL CUEING	82/54
JENNINGS, T.	BEHAVIORAL OBJECTIVES	82/54

AUTHOR'S NAME	DESCRIPTOR	YR/PAGE
JENNINGS, T.	INSTRUCTION	80/280
JOHNSON, K.A.	ITV	82/404
JONASSEN, D.H.	PERFORMANCE	80/293
JONASSEN, D.H.	PROGRAMMED INSTRUCTION	79/3364
JONASSEN, D.H.	MEMORY STRATEGIES	79/364
JONASSEN, D.H.	TEACHING	81/233
JONASSEN, D.H.	COGNITIVE STYLE	80/293
JONASSEN, D.H.	CONTENT TREATMENT INTERACTION	81/185
JONASSEN, D.H.	COGNITIVE STYLE	81/233
JONASSEN, D.H.	COGNITIVE STYLE	83/329
JORGENSEN, S.	TEACHING	81/260
JORGENSEN, S.	TECHNOLOGY	81/260
JOSEPH, J.	SUBJECT KNOWLEDGE	80/311
JOSEPH, J.	VISUALIZATION	80/311
JOSEPH, J.	ILLUSTRATIONS	80/311
JOSEPH, J.H.	INSTRUCTIONAL EFFECT	82/60
JOSEPH, J.H.	ACHIEVEMENT	83/357
JOSEPH, J.H.	INSTRUCTIONAL EFFECT	79/380
JOSEPH, J.H.	VISUALIZATION	83/357
JOSEPH, J.H.	PRESENTATION MODE	83/357
JOSEPH, J.H.	VISUALIZATION	82/60
JOSEPH, J.H.	VISUALIZATION	79/380
JOSEPH, M.R.	INSTRUCTIONAL STRATEGIES	83/370
JOSEPH, M.R.	FIELD INDEPENDENCE	83/370
JOSEPH, M.R.	COORDINATE CONCEPTS	83/370
KELLER, P.F.G.	ITV	82/404
KENNEDY, P.	TASK ANALYSIS	83/394
KENNEDY, P.	INDUSTRY	83/394
KERR, S.T.	INSTRUCTIONAL DESIGN	409
KERVIN, D.	MEDIA TECHNIQUES	84/253
KERVIN, D.	STRUCTURE	84/253
KING, F.J.	COMPUTER-BASED INSTRUCTION	84/260
KING, F.J.	RESEARCH	84/260
KLOOCK, T.R.	INSTRUCTIONAL MEDIA	82/439
KLOOCK, T.R.	FIELD DEPENDENCE	82/439
KLOOCK, T.R.	ATTITUDES	82/439
KOETTING, J.R.	PHILOSOPHICAL FOUNDATIONS	84/290
KOETTING, J.R.	INSTRUCTIONAL TECHNOLOGY	83/416
KOETTING, J.R.	TECHNOLOGY	81/289
KOETTING, J.R.	PHILOSOPHICAL FOUNDATIONS	83/416
KOETTING, J.R.	PHILOSOPHICAL FOUNDATIONS	84/307
KOETTING, J.R.	INSTRUCTIONAL DESIGN	84/307
KOETTING, J.R.	THEORY	81/289
KOETTING, J.R.	THEORY	84/290
KOETTING, J.R.	CURRICULUM THEORY	84/307
KOETTING, J.R.	NATURALISTIC INQUIRY	84/290
KORZENNY, S.S.	REINFORCEMENT	81/345
KORZENNY, S.S.	TELEVISION	81/345
KREY, C.L.	FIELD DEPENDENCE/INDEPENDENCE	83/441
KREY, C.L.	DEMOGRAPHIC	83/441
KURFISS, J.	UNIVERSITY INSTRUCTION	80/327
KURFISS, R.	CONCRETE LEARNER	80/327
LA CROIX, P.	COORDINATE CONCEPTS	83/370
LA CROIX, P.	FIELD INDEPENDENCE	83/370
LA CROIX, P.	INSTRUCTIONAL STRATEGIES	83/370
LAMBERSKI, R.	BILINGUAL LEARNERS	80/1
LAMBERSKI, R.	COGNITIVE EFFECT	80/1
LAMBERSKI, R.	COLOR	80/337
LAMBERSKI, R.	IMAGERY	80/98

AUTHOR'S NAME	DESCRIPTOR	YR/PAGE
LAMBERSKI, R.	EMPIRICAL RESEARCH	80/98
LAMBERSKI, R.	PICTORIAL ELABORATION	80/1
LAMBERSKI, R.J.	COLOR	79/417
LAMBERSKI, R.J.	COLOR	82/64
LAMBERSKI, R.J.	BLACK/WHITE LEARNING	79/417
LAMBERSKI, R.J.	INSTRUCTIONAL EFFECT	82/64
LAMBERSKI, R.J.	RETENTION	82/64
LAMBERSKI, R.J.	ACHIEVEMENT	79/417
LAPIERRE, R.C.	TELECONFERENCE	82/235
LEGENZA, A.	COMPREHENSION	79/351
LEGENZA, A.	PICTORIAL RESEARCH	79/351
LEPS, A.A.	COGNITIVE STYLE	80/381
LEPS, A.A.	VISUALIZED INSTRUCTION	80/381
LEVIE, W.H.	PICTORIAL RESEARCH	81/388
LEVIE, W.H.	LEARNER CHARACTERISTICS	80/201
LEVIE, W.H.	PICTORIAL RESEARCH	81/388
LEVIE, W.H.	INSTRUCTIONAL MEDIA	80/201
LEVIE, W.H.	MEDIA TECHNIQUES	80/201
LEWIS, R.F.	TELEVISION	79/650
LEWIS, R.F.	EVALUATION	79/650
LUKOWSKY, J.	TECHNOLOGY HISTORY	81/409
LUKOWSKY, J.	RESEARCH	81/409
MAIN, R.	LEARNING	79/267
MAIN, R.	BEHAVIORAL OBJECTIVES	79/267
MAIN, R.	AUDIOVISUAL PRESENTATION	79/267
MANN, R.E.	MUSIC	79/429
MANN, R.E.	LISTENING COMPREHENSION	79/429
MARTIN, B.L.	EDUCATION	83/460
MARTIN, B.L.	PSYCHOLOGICAL PERSPECTIVE	83/460
MARTIN, N.N.	INSTRUCTIONAL DESIGN	79/321
MARTIN, N.N.	ENVIRONMENT	79/321
MARTIN, N.N.	MEDIA SPECIALIST	79/321
MAURER, M.M.	COMPUTER ANXIETY	84/318
MAURER, M.M.	TESTING	84/318
MAURER, M.M.	COMPUTERS	84/318
MCBRIDE, S.D.	RETRIEVAL STRATEGIES	82/69
MCBRIDE, S.D.	COGNITIVE LEARNING	82/69
MCCOMBS, B.L.	COMPUTERS	84/331
MCCOMBS, B.L.	COGNITIVE STYLE	84/331
MCCOMBS, B.L.	INSTRUCTIONAL MANAGEMENT	84/331
MCGRADY, D.S.	PROGRAMMED INSTRUCTION	84/354
MCGRADY, D.S.	COMPREHENSION	84/354
MCISAAC, M.S.	PICTORIAL RESEARCH	83/478
MCISAAC, M.S.	NATURALISTIC INQUIRY	84/386
MCISAAC, M.S.	PHOTOGRAPHY	84/386
MCISAAC, M.S.	PICTORIAL RESEARCH	84/386
MCISAAC, M.S.	PHOTOGRAPHY	83/478
MCISAAC, M.S.	AESTHETICS	81/428
MCISAAC, M.S.	PHOTOGRAPHY	81/428
MCLESKEY, J.	INSTRUCTIONAL MEDIA	80/201
MCLESKEY, J.	LEARNER CHARACTERISTICS	80/201
MCLESKEY, J.	MEDIA TECHNIQUES	80/201
MELLON, C.A.	INSTRUCTIONAL DESIGN	82/453
MELLON, C.A.	NATURALISTIC INQUIRY	83/487
MELLON, C.S.	FACULTY	82/453
MELVIN, K.	TEACHER THEORIES	82/197
MELVIN, K.	TEACHER PRACTICES	82/197
MOORE, D.M.	INSTRUCTIONAL METHODS	81/471
MOORE, D.M.	MEDIA UTILIZATION	81/471

AUTHOR'S NAME	DESCRIPTOR	YR/PAGE
MORGAN, R.M.	EDUCATIONAL DEVELOPMENT	79/682
MOSELY, M.L.	PROSE LEARNING	83/707
MOSLEY, M.L.	TEACHERS	83/502
MOSLEY, M.L.	IMAGERY	83/707
MOSLEY, M.L.	COMPUTER-ASSISTED INSTRUCTION	84/402
MOSLEY, M.L.	MOTIVATION	84/402
MOSLEY, M.L.	MOTIVATION	83/502
MUFFOLETTO, R.	VISUALIZATION	82/469
MUFFOLETTO, R.	CRITICAL DIALOGUE	82/469
NELSON, J.	REVIEWING METHODS	80/389
NELSON, J.	COMPUTER-ASSISTED INSTRUCTION	80/389
NESBIT, L.J.	COGNITIVE LEARNING	81/445
NESBIT, L.J.	EYE MOVEMENT	81/445
NESBIT, L.L.	LEARNING	82/478
NESBIT, L.L.	EYE MOVEMENT	82/478
NEWELL, K.J.	DENTAL HYGIENE	83/156
NEWELL, K.J.	FIELD DEPENDENCE/INDEPENDENCE	83/156
NIELSON, T.	CONTROL FUNCTION	80/424
NIELSON, T.	CONTINUING EDUCATION	80/424
NOVAK, J.	TASK ANALYSIS	83/394
NOVAK, J.	INDUSTRY	83/394
OLSON, J.S.	AUDITORY LEARNING	83/517
OLSON, J.S.	AUDITORY LEARNING	84/414
OLSON, J.S.	RATE-MODIFIED SPEECH	82/483
OLSON, J.S.	TIME-COMPRESSED SPEECH	83/517
OLSON, J.S.	TIME-COMPRESSED SPEECH	84/414
OLSON, J.S.	RESEARCH	82/483
OLSON, J.S.	COGNITIVE STYLE	83/517
OLSON, J.S.	COGNITIVE STYLE	84/414
OXFORD, J.F.	INSTRUCTIONAL METHODS	81/471
OXFORD, J.F.	MEDIA UTILIZATION	81/471
PARKHURST, P.E.	VISUALIZED INSTRUCTION	82/81
PARKHURST, P.E.	ATI	79/83
PARKHURST, P.E.	OPERATIONAL ENVIRONMENT	79/83
PARKHURST, P.E.	COMPREHENSION	82/81
PARKHURST, P.E.	ACHIEVEMENT	82/81
PECK, K.L	AURAL INSTRUCTION	83/533
PECK, K.L.	VIDEOTAPED INSTRUCTION	83/533
PECK, K.L.	RETENTION	83/533
PECK, M.L.	INTERACTION	83/561
PECK, M.L.	APTITUDE	83/561
RABURN, J.	TESTING	82/519
RABURN, J.	MUSIC	82/519
RABURN, J.	FILM	82/519
RAGAN, T.	INDIVIDUALIZATION	84/433
RAGAN, T.	RESEARCH	84/433
RAGAN, T.	COMPUTERS	84/433
RAGSDALE, R.G.	EDUCATIONAL TECHNOLOGY	82/543
RAGSDALE, R.G.	COMPUTERS	82/543
RANCOURT, R.	PSYCHOEPISTEMOLOGY	81/486
RANCOURT, R.	HEMISPHERICITY	81/486
RASZAKOWSKI, R.R.	TELECONFERENCE	83/283
REEVES, W.J.	ATTITUDES	82/360
REEVES, W.J.	MEDIA PROGRAM	82/360
REGENSCHEID, J.K.	ACHIEVEMENT	83/643
REGENSCHEID, J.K.	CUEING	83/643
REGENSCHEID, J.K.	COMPUTER-ASSISTED INSTRUCTION	83/643
REID, G.A.	INSTRUCTIONAL DESIGN	81/509
REID, G.A.	LEARNING HIERARCHIES	81/509

AUTHOR'S NAME	DESCRIPTOR	YR/PAGE
REID, G.A.	RESEARCH	81/509
REIGELUTH, C.	SUBSUMPTIVE SEQUENCING	80/527
REIGELUTH, C.	COGNITIVE SKILLS	80/527
REIGELUTH, C.	CO-ORDINATION	80/527
REIGELUTH, C.M.	INSTRUCTIONAL DESIGN	79/100
REIGELUTH, C.M.	ELABORATION THEORY	79/100
RICHARDS, B.	TRANSFER OF LEARNING	84/446
RICHARDS, B.	PRIOR KNOWLEDGE	84/446
RICKARD, D.	VISUAL PERCEPTION	80/262
RICKARD, D.	BILINGUAL EDUCATION	80/262
ROBERTS, D.M.	DWYER RESEARCH	82/90
ROBERTS, D.M.	RETENTION	82/90
ROBERTS, D.M.	RESEARCH	79/132
ROBERTS, D.M.	CONSUMERS	79/132
ROBERTS, D.M.	COLOR	79/417
ROBERTS, D.M.	BLACK/WHITE LEARNING	79/417
ROBERTS, D.M.	ACHIEVEMENT	79/417
ROBINSON, R.S.	TELEVISION	84/466
ROBINSON, R.S.	FILM	81/535
ROBINSON, R.S.	COMPREHENSION	84/466
ROBINSON, R.S.	CINEMATIC ELEMENTS	81/535
ROBINSON, R.S.	AFFECTIVE RESPONSES	81/535
ROBLYER, M.D.	RESEARCH	84/260
ROBLYER, M.D.	COMPUTER-BASED INSTRUCTION	84/260
ROHNER, D.J.	COMPUTER ANXIETY	81/549
ROSEN, T.	COMPUTERS	83/719
ROSEN, T.	TEACHERS	83/719
ROSENSWEIG, D.	TEACHERS	83/719
ROSENSWEIG, D.	COMPUTERS	83/719
RUSSELL, A.L.	MEDIA MATERIALS	82/548
RUSSELL, A.L.	UNIVERSITY INSTRUCTION	82/548
SAIET, R.A.	MOTION CUES	457
SAIET, R.E.	CHILDREN	79/457
SAVENYE, W.	CAREERS	83/668
SAVENYE, W.	ATTITUDES	83/668
SAVENYE, W.	PRESENTATION MODE	83/668
SCHMID, R.	PERCEPTUAL-MOTOR	80/217
SCHMID, R.	ALGORITHMIC INSTRUCTION	80/217
SCHMID, R.	ALGORITHMIC INSTRUCTION	80/440
SCHMID, R.E.	BEHAVIORAL OBJECTIVES	79/241
SCHMID, R.F.	FEEDBACK	79/212
SCHMID, R.F.	SELF EVALUATION	79/212
SCHWEN, T.	COGNITIVE STYLE	79/303
SCHWEN, T.	COGNITIVE APTITUDE	79/303
SCHWEN, T.	ACADEMIC SUCCESS	79/303
SCHWEN, T.M.	APTITUDE	81/1
SCHWEN, T.M.	ATI	81/1
SEWELL, E.H.	INFORMATION PROCESSING	79/496
SEWELL, E.H.	ILLUSTRATIONS	79/496
SEWELL, E.H.	COMPREHENSION	79/496
SHERIFF, D.E	FIELD DEPENDENCE/INDEPENDENCE	80/445
SHERIFF, D.E.	INSTRUCTIONAL DEVELOPMENT	80/445
SHERIFF, D.E.	AV COMMUNICATION REVIEW	79/140
SHERIFF, D.E.	RESEARCH	79/140
SHERMAN, T.	TASK ANALYSIS	80/460
SHERMAN, T.	LEARNING	80/460
SHRIGLEY, R.	ATTITUDES	80220
SHRIGLEY, R.	PRESERVICE TEACHERS	80/220
SHRIGLEY, R.	PERSUASION	80/220

AUTHOR'S NAME	DESCRIPTOR	YR/PAGE
SHROCK, S,A	PROGRAM EVALUATION	83/682
SHROCK, S.A.	NATURALISTIC INQUIRY	83/682
SIMONSON, M.	FIELD DEPENDENCE	82/439
SIMONSON, M.	INSTRUCTIONAL MEDIA	82/439
SIMONSON, M.	ATTITUDES	82/439
SIMONSON, M.	INSTRUCTIONAL DESIGN	79/521
SIMONSON, M.	PUBLICATIONS	84/118
SIMONSON, M.	RESEARCH	84/118
SIMONSON, M.R.	FILM	81/586
SIMONSON, M.R.	PERSUASION	83/58
SIMONSON, M.R.	COMPUTER ANXIETY	84/318
SIMONSON, M.R.	FEAR	83/58
SIMONSON, M.R.	ATTITUDES	81/586
SIMONSON, M.R.	ATTITUDES	82/561
SIMONSON, M.R.	ATTITUDES	79/521
SIMONSON, M.R.	MEDIATED INSTRUCTION	82/561
SIMONSON, M.R.	INSTRUCTIONAL MEDIA	80/473
SIMONSON, M.R.	PERSUASION	81/586
SIMONSON, M.R.	ATTITUDES	80/473
SIMONSON, M.R.	TESTING	84/318
SIMONSON, M.R.	COMPUTER ANXIETY	81/549
SIMONSON, M.R.	COMPUTERS	84/318
SMITH, P.L.	RESEARCH	84/487
SMITH, P.L.	INSTRUCTIONAL DESIGN	84/487
SMITH, P.L.	COGNITIVE STYLE	84/487
SOLANO, F.	SPECIAL EDUCATION	82/105
SOLANO, F.	EVALUATION	82/105
SOLANO. F.	INSTRUCTIONAL SYSTEMS	82/105
SPITZER, D.R.	NEEDS ASSESSMENT	79/543
SPLAINE, J.	MANAGEMENT	81/611
STEIN, F.	CO-ORDINATION	80/527
STEIN, F.	SUBSUMPTIVE SEQUENCING	80/527
STEIN, F.	COGNITIVE SKILLS	80/527
STORY, N.	MOTIVATION	84/402
STORY, N.	COMPUTER-ASSISTED INSTRUCTION	84/402
STORY, N.O.	IMAGERY	83/707
STORY, N.O.	PROSE LEARNING	83/707
STREIBEL, M.J.	COGNITIVE STYLE	81/624
STREIBEL, M.J.	EMBEDDED FIGURES TEST	81/624
STREIBEL, M.J.	ROD AND FRAME TEST	81/624
SULLILVAN, H.	RELEVANCE	80/569
SULLIVAN, H.	ILLUSTRATIONS	80/569
SZABO, M.	ENCODING	81/120
SZABO, M.	VISUAL TESTING	81/120
TANTIBLARPHOL, S.	PICTORIAL RESEARCH	84/499
TANTIBLARPHOL, S.	COMPREHENSION	84/499
TANTIBLARPHOL, S.	TIME-COMPRESSED SPEECH	84/499
TAYLOR, W.	INFORMATION PROCESSING	81/88
TAYLOR, W.	FIELD DEPENDENCE	81/88
TAYLOR, W.	CUEING	84/72
TAYLOR, W.	RETENTION	83/125
TAYLOR, W.	MEDIATED INSTRUCTION	84/72
TAYLOR, W.	LEARNING	84/72
TAYLOR, W.	NETWORKING	81/88
TAYLOR, W.	INFORMATION CUEING	83/125
TAYLOR, W.	VISUALIZED INSTRUCTION	82/183
TAYLOR, W.	ENCODING	83/125
TAYLOR, W.	LEARNING	82/183
TORKELSON, G.M.	MEDIA	84/534

AUTHOR'S NAME	DESCRIPTOR	YR/PAGE
TORKELSON, G.M.	RESEARCH	84/534
TORKELSON, G.M.	RESEARCH	81/664
TORKELSON, G.M.	THEORY	84/534
TURNER, M.L.	ASSESSMENT	79/552
TURNER, M.L.	VISUAL LITERACY	79/552
TURNER, P.	ENVIRONMENT	79/321
TURNER, P.	INSTRUCTIONAL DESIGN	79/321
TURNER, P.	MEDIA SPECIALIST	79/321
TURNER, P.M.	ANXIETY	82/581
TURNER, P.M.	CONCEPT LEARNING	82/581
TURNER, P.M.	VISUALIZATION	82/581
TYSON, L.	FILM	82/519
TYSON, L.	MUSIC	82/519
TYSON, L.	TESTING	82/519
VALACH, M.	ALGORITHMIC INSTRUCTION	80/440
WANIEWICZ, I.	TEACHERS	83/719
WANIEWICZ, I.	COMPUTERS	83/719
WATSON-GEGEO, K.A.	ETHNOGRAPHY	81/670
WELLIVER, P.	ATTITUDES	80/220
WELLIVER, P.	PRESERVICE TEACHERS	80/220
WELLIVER, P.	PERSUASION	80/220
WHITAKER, J.	RELEVANCE	80/569
WHITAKER, J.	ILLUSTRATIONS	80/569
WHITE, B.H.	RESEARCH	79/144
WHITE, B.H.	PRACTITIONER	79/144
WIECKOWSKI, T.	COGNITIVE STYLE	80/594
WIECKOWSKI, T.	PICTORIAL RESEARCH	80/594
WIECKOWSKI, T.	COLOR	80/594
WILDMAN, T.	TASK ANALYSIS	80/460
WILDMAN, T.	EVALUATION	80/630
WILDMAN, T.	LEARNING	80/460
WILDMAN, T.	MATCHING LEARNING THEORY	80/630
WILDMAN, T.	INSTRUCTIONAL TECHNOLOGY	80/630
WILLIAMS, D.M.	SELF CONCEPT	82/621
WILLIAMS, D.M.	ELEMENTARY MEDIA CENTERS	82/621
WILLIAMS, J.A.	FIELD DEPENDENCE/INDEPENDENCE	80/445
WILLIAMS, J.A.	EVALUATION	84/563
WILLIAMS, J.A.	THEORY	84/563
WILLIAMS, J.A.	INSTRUCTIONAL DESIGN	84/563
WILLIAMS, J.A.	INSTRUCTIONAL DEVELOPMENT	80/445
WINN, B.	BRAIN RESEARCH	83/736
WINN, B.	EDUCATIONAL TECHNOLOGY	84/607
WINN, B.	PUBLICATIONS	84/607
WINN, B.	INSTRUCTIONAL DESIGN	83/736
WINN, B.	INSTRUCTIONAL MEDIA	79/580
WINN, B.	FIELD TEST	79/580
WINN, B.	RESEARCH	84/607
WINN, W.	VISUAL LITERACY	80/646
WINN, W.	INFORMATION PROCESSING	80/646
WINN, W.	THEORY	80/646
WINN, W.D.	DIAGRAMS	81/715
WINN, W.D.	LEARNING	81/715
WINN. B.	VISUAL LEARNING	82/638
WISE, R.E.	COGNITIVE SKILLS	82/671
WISE, R.E.	ICONIC STIMULUS	82/671
WITHAM, J.	COGNITIVE SKILLS	80/527
WITHAM, J.	SUBSUMPTIVE SEQUENCING	80/527
WITHAM, J.	CO-ORDINATION	80/527
YACOBACCI, P.M.	SPECIAL EDUCATION	82/105

AUTHOR'S NAME	DESCRIPTOR	YR/PAGE
YACOBACCI, P.M.	INSTRUCTIONAL SYSTEMS	82/105
YACOBACCI, P.M.	EVALUATION	82/105

CUMULATIVE 1985-1986 SUBJECT INDEX

DESCRIPTOR	AUTHOR'S NAME	YR/PG
ACHIEVEMENT	HANNAFIN, M.J.	85/101
ACQUISITION SKILLS	ALLEN, B.S.	85/29
ADVANCE ORGANIZER	HANCLOSKY, W.V.	86/313
AFFILIATED CABLE TELEVISION	DUDT, K.P.	86/195
AFFILIATED CABLE TELEVISION	LAMBERSKI, R.J.	86/195
AFFILIATED CABLE TELEVISION	LAMBERSKI, R.J.	86/185
AFFILIATED CABLE TELEVISION	DUDT, K.P.	86/185
ALGEBRA	ALBRIGHT, M.J.	85/1
ANALYTIC ABILITY	FRENCH, M.	85/193
ATTITUDE	HANNAFIN, M.J.	86/153
ATTITUDE	DALTON, D. W.	86/119
ATTITUDE	DALTON, D.W.	86/153
ATTITUDES	GREATHOUSE, S.	86/85
ATTITUDES	CARL, D.L.	86/85
ATTITUDES	CARL, R.R.	86/85
CAI STRATEGIES	RAGAN, T.J.	86/542
CASE STUDY METHODOLOGY	KING, J.W.	85/418
CHILDREN	STORM, S.R.	85/813
COGNITION	FOSNOT, C.T.	85/164
COGNITION	FORMAN, G.E.	85/164
COGNITIVE MONITORING	HANNAFIN, M.	86/230
COGNITIVE MONITORING	GARHART,C.	86/230
COLLECTION SCALES	LOERTSHCER. D.	86/390
COLLECTION SCALES	HO, M.L.	86/390
COMMUNICATION PROGRAMS	KING, J.W.	85/418
COMPARISON STRATEGIES	ALLEN, B.S.	85/29
COMPUTER DISPLAY	JONASSEN, D.H.	86/451
COMPUTER GRAPHICS	BELLAND, J.C.	86/36
COMPUTER GRAPHICS	BAKER, P.R.	86/36
COMPUTER GRAPHICS	CAMBRE, M.A.	86/36
COMPUTER INSERVICE	WEDMAN, J. F.	86/782
COMPUTER LITERACY	STEVENSON, R.B.	85/797
COMPUTER LITERACY ASSESSMENT	TORARDI, M.M.	85/860
COMPUTER-ASSISTED INSTRUCTION	HANNAFIN, M.	85/252
COMPUTER-ASSISTED INSTRUCTION	GOETZFRIED, L.	85/252
COMPUTER-BASED INSTRUCTION	TOUGER, H.E.	85/889
COMPUTER-BASED INSTRUCTION	SMITH, P.	86/656
COMPUTER-BASED INSTRUCTION	WILSON, B.G.	85/901
COMPUTER-BASED INSTRUCTION	BAKER, P.	85/146
COMPUTER-BASED INSTRUCTION	HANNAFIN, M.	86/336
COMPUTER-BASED INSTRUCTION	GARHART, C.	86/230
COMPUTER-BASED INSTRUCTION	GARHART, C.	86/336
COMPUTER-BASED INSTRUCTION	HANNAFIN, M.	86/230
COMPUTER-BASED INSTRUCTION	DWYER, F.	85/146
COMPUTER-BASED INSTRUCTION	BELLAND, J.	85/146
COMPUTER-BASED INSTRUCTION	CANELOS, J.	85/146
COMPUTER-BASED INSTRUCTION	GARHART, C.	86/336
COMPUTER-BASED INSTRUCTION	TAYLOR, W.	85/146
COMPUTER-BASED INSTRUCTION	SEIDNER, C.J.	85/889
COMPUTER-BASED INSTRUCTION	RIEBER, L.P.	86/336
COMPUTER-BASED INSTRUCTION	PHILLIPS, T.L.	86/336
COMPUTER-BASED REINFORCEMENT	HANNAFIN, M.J.	85/101
COMPUTER-BASED REINFORCEMENT	DALTON, D.W.	85/101

DESCRIPTOR	AUTHOR'S NAME	YR/PG
COMPUTER-GENERATED TEXT	GRABINGER, R. S.	86/271
COMPUTER-MANAGED INSTRUCTION	MORRISON, G.R.	86/530
COMPUTER-MANAGED INSTRUCTION	ROSS, S.M.	86/530
COMPUTERPHOBIA	JONASSEN, D.H.	86/461
COMPUTERS	SALISBURY, D.F.	85/663
COMPUTERS	STACY, N.O.	86/620
COMPUTERS	MATTHIAS, M.	85/703
COMPUTERS	CARL, R.R.	86/85
COMPUTERS	MOSELY, M.L.	86/620
COMPUTERS	GREATHOUSE, S.	86/85
COMPUTERS	ANASTASOFF, J.	85/703
COMPUTERS	VENSEL, C.	85/703
COMPUTERS	GRIBBLE, M.	85/318
COMPUTERS	SHROCK, S.A.	85/703
COMPUTERS	SHAW, S.	85/703
COMPUTERS	GAMSKY, D.	85/318
COMPUTERS	MUFFOLETTO, R.	85/318
COMPUTERS	SULLIVAN, H.J.	86/620
COMPUTERS	SEYMOUR, S.L.	86/620
COMPUTERS	CARL, D.L.	86/85
CONCEPT LEARNING	HART, R.A.	85/332
COURSEWARE	ALESANDRINI, K.	85/18
CUEING	SMITH, P.L.	86/635
CURRICULUM CHANGES	BRATTON, B.	86/421
CURRICULUM CHANGES	GJERDE, C.L.	86/421
CURRICULUM CHANGES	HOUSE, J.D.	86/421
CURRICULUM DIRECTORS	HO, M.L.	85/372
DOGMATISM	REHN, R.A.	85/557
DRILL AND PRACTICE	SALISBURY, D.F.	85/663
EFFICACY OF LOGO	RIEBER, L.P.	86/562
EFFICACY OF LOGO	DALTON, D.W.	86/119
ELECTRONIC BOOKS	YEAMAN, A.R.J.	85/921
ELECTRONIC MAIL	TILLMAN, M.H.	86/220
ELECTRONIC MAIL	GARDNER, C.H.	86/220
EMPOWERED LEARNING	STEVENSON, R.B.	85/797
ENCODING	BELLAND, J.	85/87
ENCODING	DWYER, F.	85/87
ENCODING	CANELOS, J.	85/87
ENCODING	TAYLOR, W.	85/87
EVALUATION	RANDALL, J.P.	86/552
FEEDBACK	NISHIKAWA, S.S.	85/530
FIELD DEPENDENCE/INDEPENDENCE	MOORE, D.M.	85/485
FILM	BOWIE, M.M.	86/49
FILM THEORY	DEGRAFF, J.	85/125
FILMIC CODING	LYNCH, B.E.	86/521
GRADUATE EDUCATION	HALES. R.H.	86/302
GRADUATE EDUCATION	HOUSE, J.D.	86/421
GRADUATE EDUCATION	FELT, S.B.	86/302
GRADUATE EDUCATION	GJERDE, C.L.	86/421
GRADUATE EDUCATION	BRATTON, B.	86/421
GRADUATE STUDENTS	WELLIVER, P. W.	86/797
GRAPHICS	ALESANDRINI, K.	85/18
ILLUSTRATIONS	ANGLIN, G.J.	85/57

DESCRIPTOR	AUTHOR'S NAME	YR/PG
ILLUSTRATIONS	HURT, J.A.	85/392
IMAGERY	HORTIN, J.A.	85/386
IMAGERY	MOORE, D.M.	85/485
INCENTIVE	ALBRIGHT, M.J.	85/1
INDIVIDUAL DIFFERENCES	BELLAND, J.	85/146
INDIVIDUAL DIFFERENCES	CANELOS, J.	85/146
INDIVIDUAL DIFFERENCES	BAKER, P.	85/146
INDIVIDUAL DIFFERENCES	DWYER, F.	85/146
INDIVIDUAL DIFFERENCES	TAYLOR, W.	85/146
INSERVICE DESIGN	WEDMAN. J.F.	86/782
INSTRUCTION	FRENCH, M.	85/220
INSTRUCTIONAL DESIGN	TAYLOR, W.	85/87
INSTRUCTIONAL DESIGN	ROSSETT, A.	86/612
INSTRUCTIONAL DESIGN	BELLAND, J.	85/87
INSTRUCTIONAL DESIGN	DWYER, F.	85/87
INSTRUCTIONAL DESIGN	CANELOS, J.	85/87
INSTRUCTIONAL DESIGN	RAGAN, T.J.	86/542
INSTRUCTIONAL METHODS	REHN, R.A.	85/557
INSTRUCTIONAL STRATEGIES	FRENCH, M.	85/193
INSTRUCTIONAL STRATEGY	BAKER, P.	86/65
INSTRUCTIONAL STRATEGY	DWYER, F.	86/65
INSTRUCTIONAL STRATEGY	BELLAND, J.	86/177
INSTRUCTIONAL STRATEGY	TAYLOR, W.	86/65
INSTRUCTIONAL STRATEGY	CANELOS, J.	86/65
INSTRUCTIONAL TECHNOLOGY	MORIN, A.	85/499
INSTRUCTIONAL TECHNOLOGY	GAGNON, R.	85/232
INSTRUCTIONAL TELEVISION	JONES, P.E.	86/478
INSTRUCTIONAL TELEVISION	SALCEDO, A.M.	85/650
INSTRUCTIONAL TELEVISOIN	TIENE, D.	86/721
INTERACTIVE CABLE TELEVISION	WEST, P.C.	86/598
INTERACTIVE CABLE TELEVISION	ROBINSON, R.S.	86/598
INTERACTIVE TELEVISION	ROBINSON, R.S.	85/623
INTERACTIVE VIDEO	ABRAMS, A.	86/1
INTERACTIVE VIDEO	LYNESS, A.L.	85/462
LEARNING STRATEGIES	CANELOS, J.	85/848
LEARNING STRATEGIES	CANELOS, J.	85/848
LEARNING STRATEGIES	NICHOLS, R.	85/848
LEARNING STRATEGIES	DWYER, F.	85/848
LEARNING STRATEGIES	TAYLOR, W.	85/848
LEARNING STYLES	KLOOK, T	85/750
LEARNING STYLES	AEGERTER, R.	85/750
LEARNING STYLES	BOWIE, M.M.	86/49
LEARNING STYLES	STONE, R.	85/750
LEARNING STYLES	COOK, S.	85/750
LEARNING STYLES	SIMONSON, M.R.	85/750
LEARNING STYLES	BERRY, T.	85/750
LIBRARY MANAGEMENT	RIGGS, D.E.	86/252
LIBRARY MANAGEMENT	ALEAMONI, L.M.	86/252
LIBRARY MANAGEMENT	GOTHBERG, H.M.	86/252
LIST VS. FLOW CHART	JONASSEN, D.H.	86/469
LIST VS. FLOW CHART	PEARSON, M.	86/469
MANAGEMENT	HALES, R.L.	86/302
MANAGEMENT	FELT, S.B.	86/302

DESCRIPTOR	AUTHOR'S NAME	YR/PG
MAPPING	LOERTSCHER, D.	86/390
MAPPING	HO, M.L.	86/390
MATHEMATICS	HANNAFIN, M.	85/252
MATHEMATICS	GOETZFRIED, L.	85/252
MEDIA ATTRIBUTES	HART, R. A.	86/358
MEDIA LIBRARIES	HORTIN, J.A.	86/410
MEDIA SELECTION	EVANS, L.J.	86/210
MEDIA SERVICES	RANDALL, J.P.	86/552
MEDIA UTILIZATION	HANNAFIN, M.J.	86/153
MEDIA UTILIZATION	SEIDMAN, S.A.	85/678
MEDIA UTILIZATION	DALTON, D.W.	86/153
MEDIA UTILIZATION	CHUTE, A.G.	86/106
MOTIVATION	STORY, N.O.	86/620
MOTIVATION	SEYMOUR, S.L.	86/620
MOTIVATION	SULLIVAN, H.J.	86/620
MOTIVATION	MOSELY. M.L.	86/620
NONCOMMERCIAL FM RADIO	LEIDMAN,M.B.	86/490
NONCOMMERCIAL FM RADIO	LEIDMAN, M.B.	86/505
NONCOMMERCIAL FM RADIO	LAMBERSKI, R.J.	86/505
NONCOMMERCIAL FM RADIO	LAMBERSKI. R.J.	86/490
NOTETAKING	CANELOS, J.	85/848
NOTETAKING	TAYLOR, W.	85/848
NOTETAKING	NICHOLS, R.	85/848
NOTETAKING	DWYER, F.	85/848
PACING	TAYLOR, W.	86/65
PACING	BAKER. P.	86/65
PACING	DWYER, F.	86/65
PACING	BELLAND, J.	86/65
PACING	CANELOS, J.	86/65
PERCEPTUAL/COGNITIVE TASK	JONASSEN D.H.	86/451
PERSON-ENVIRONMENT FIT	YEAMEN, A. R.	86/833
PERSUASION	STONE, R.	85/750
PERSUASION	SIMONSON, M.R.	85/750
PERSUASION	KLOOK, T	85/750
PERSUASION	COOK, S.	85/750
PERSUASION	SIMONSON, M.R.	86/763
PERSUASION	TREIMER, M.	86/763
PERSUASION	AEGERTER, R.	85/750
PERSUASION	BERRY, T.	85/750
PHOTOGRAPHY SKILLS	ABRAMS, A.	86/1
PICTURE EFFECTS	ANGLIN, G.J.	86/15
PROBLEM SOLVING	RIEBER, L. P.	86/562
PROCESSING	SMITH, P.L.	86/635
PROSE	HURT, J.A.	85/392
PROSE	ANGLIN, G.J.	85/57
PUBLIC TELEVISION	TIENE, D.	86/ 721
PUZZLE SOLVING	HORTIN, J.A.	85/386
RADIO	LAMBERSKI. R.J.	86/490
RADIO	LEIDMAN, M.B.	86/490
RADIO	LEIDMAN, M.B.	86/505
RADIO	LAMBERSKI, R.J.	86/505
RECALL	ANGLIN, G.J.	86/15
REGRESSION MODEL	MORRISON, G.R.	86/530

DESCRIPTOR	AUTHOR'S NAME	YR/PG
REGRESSION MODEL	ROSS, S.M.	86/530
REINFORCEMENT	DALTON, D.W.	85/101
RESEARCH	FRENCH, M.	85/220
RESEARCH	BECKER, A.	85/72
RESEARCH	YEAMAN, A.R.J.	85/921
RESEARCH	JONES, P.E.	86/478
RESEARCH	MOLINA, R.R.	85/479
RESEARCH TRENDS	WINN, W.	86/801
SCREEN DESIGN	CAMBRE, M.A.	86/36
SCREEN DESIGN	BELLAND, J.C.	86/36
SCREEN DESIGN	BAKER, P.R.	86/36
SEARCH TASK	PEARSON, M.	86/469
SEARCH TASK	JONASSEN, D. H.	86/469
SIMULATION	SMITH, P.	86/656
SOCIAL INTERACTION	SILVERSTEIN, M.A.	85/717
SPATIAL RELATIONSHIPS	LYNCH, B.E.	86/521
SPATIAL VISUALIZATION	MOLINA, R.R.	85/479
SPEECH	OLSON, J.S.	85/558
STATE ANXIETY	JONASSEN, D.H.	86/461
SUBLIMINAL MESSAGES	TREIMER, M.	86/763
SUBLIMINAL MESSAGES	SIMONSON, M. R.	86/763
SYNTACTIC PLACEMENT	HART, R.A.	85/332
SYNTHESIZING STRATEGIES	WILSON, B.G.	85/901
TASK ANALYSIS	HANCLOSKY, W. V.	86/313
TASK PERFORMANCE	SEIDNER, C.J.	85/889
TASK PERFORMANCE	TOUGER, H.E.	85/889
TEACHER BURNOUT	SEIDMAN, S.A.	85/678
TEACHER SOCIALIZATION	GAMSKY, D.	85/318
TEACHER SOCIALIZATION	GRIBBLE, M.	85/318
TEACHER SOCIALIZATION	MUFFOLETTO, R.	85/318
TEACHER/PRINCIPAL ATTITUDES	HORTIN, J.A.	86/410
TEACHING ANALYSIS	KOETTING, J.R.	85/437
TEACHING INSTITUTIONS	HO, M.L.	85/372
TECHNICAL PRESENTATIONS	OLSON, J.S.	85/558
TELETRAINING	CHUTE, A.G.	86/106
TELEVISION	LAMBERSKI, R.J.	86/195
TELEVISION	LAMBERSKI, R.J.	86/185
TELEVISION	DUDT, K.P.	86/185
TELEVISION	TIENE, D.	86/745
TELEVISION	STORM, S.R.	85/813
TELEVISION	DUDT, K.P.	86/195
TELEVISION	DEGRAFF, J.	85/125
TEXT DESIGN	SMITH, P.L.	85/783
TEXT FORMAT	GRABINGER, R.S.	86/271
TEXT LAYOUT	AMEDEO, D.	85/280
TEXT LAYOUT	GRABINGER, R.S.	85/280
THEORY	MORIN, A.	85/499
THEORY	BECKER, A.	85/72
TIME MANAGEMENT	GOTHBERG, H.M.	86/252
TIME MANAGEMENT	RIGGS, D.E.	86/252
VIDEO	FOSNOT, C.T.	85/164
VIDEO	FORMAN, G.E.	85/164
VIDEO	KOETTING, J.R.	85/437

DESCRIPTOR	AUTHOR'S NAME	YR/PG
VIDEODISC SYSTEM	SILVERSTEIN, M.A.	85/717
VISUALIZATION	HART. R.A.	86/358
WORD PROCESSING	WATSON, J.F.	86/166
WORD PROCESSING	DALTON, D.W.	86/166
WRITING SKILLS	DALTON, D.W.	86/165
WRITING SKILLS	WATSON, J.F.	86/166

CUMULATIVE 1979-1984 SUBJECT INDEX

DESCRIPTOR	AUTHOR'S NAME	YR/PAGE
ABSTRACT LEARNING	CAREY, J.O.	81/105
ABSTRACT LEARNING	HANNIFIN, M.J.	81/105
ACADEMIC SUCCESS	BEDNAR, A.K.	79/303
ACADEMIC SUCCESS	SCHWEN, T.	79/303
ACHIEVEMENT	DWYER, F.M.	82/54
ACHIEVEMENT	PARKHURST, P.E.	82/81
ACHIEVEMENT	LAMBERSKI, R.J.	79/417
ACHIEVEMENT	JOSEPH, J.H.	83/357
ACHIEVEMENT	JENNINGS, T.	80/280
ACHIEVEMENT	REGENSCHEID, J.K.	83/643
ACHIEVEMENT	JENNINGS, T.	82/54
ACHIEVEMENT	ROBERTS, D.M.	79/417
ADMINISTRATORS	CARL, D.L.	84/99
ADMINISTRATORS	HOELSCHER, S.	84/99
AESTHETICS	MCISAAC, M.S.	81/428
AFFECTIVE RESPONSES	ROBINSON, R.S.	81/535
ALGORITHMIC INSTRUCTION	GERLACH, V.	80/217
ALGORITHMIC INSTRUCTION	SCHMID, R.	80/440
ALGORITHMIC INSTRUCTION	GERLACH, V.	80/440
ALGORITHMIC INSTRUCTION	VALACH, M.	80/440
ALGORITHMIC INSTRUCTION	SCHMID, R.	80/217
AMERICANESE	HARRISON, R.T.	83/776
AMERICANESE	CROSSMAN, J.	83/776
ANALYSIS	HANNAFIN, M.J.	82/325
ANXIETY	TURNER, P.M.	82/581
APTITUDE	FRENCH, M.	83/226
APTITUDE	ANGLIN, J.B.	81/1
APTITUDE	FRENCH, M.	84/178
APTITUDE	PECK, M.L.	83/561
APTITUDE	SCHWEN, T.M.	81/1
APTITUDE	ANGLIN, G.J.	81/1
ASSESSMENT	TURNER, M.L.	79/552
ASSESSMENT	ERNEST, P.S.	82/278
ATI	SCHWEN, T.M.	81/1
ATI	ANGLIN, G.J.	81/1
ATI	ANGLIN, J.B.	81/1
ATI	PARKHURST, P.E.	79/88
ATTENTION	BRAVERMAN, M.	81/78
ATTITUDES	GRABOWSKI, B.	80/220
ATTITUDES	KLOOCK, T.R.	82/439
ATTITUDES	WELLIVER, P.	80/220
ATTITUDES	SIMONSON, M.R.	82/561
ATTITUDES	HODGES, Y.A.	82/360
ATTITUDES	SIMONSON, M.	82/439
ATTITUDES	SIMONSON, M.R.	80/473
ATTITUDES	SIMONSON, M.R.	79/521
ATTITUDES	DRESANG, E.T.	82/256
ATTITUDES	REEVES, W.J.	82/360
ATTITUDES	SIMONSON, M.R.	81/586
ATTITUDES	SAVENYE, W.	83/668
ATTITUDES	COOK, S.	82/439
ATTITUDES	SHRIGLEY, R.	80220
ATTITUDES	GRAY, J.	82/360
AUDIOVISUAL PRESENTATION	MAIN, R.	79/267
AUDITORY LEARNING	OLSON, J.S.	83/517
AUDITORY LEARNING	OLSON, J.S.	84/414
AUDITORY LEARNING	BERRY, L.H.	83/517
AURAL INSTRUCTION	PECK, K.L	83/533

DESCRIPTOR	AUTHOR'S NAME	YR/PAGE
ABSTRACT LEARNING	CAREY, J.O.	81/105
ABSTRACT LEARNING	HANNIFIN, M.J.	81/105
ACADEMIC SUCCESS	BEDNAR, A.K.	79/303
ACADEMIC SUCCESS	SCHWEN, T.	79/303
ACHIEVEMENT	DWYER, F.M.	82/54
ACHIEVEMENT	PARKHURST, P.E.	82/81
ACHIEVEMENT	LAMBERSKI, R.J.	79/417
ACHIEVEMENT	JOSEPH, J.H.	83/357
ACHIEVEMENT	JENNINGS, T.	80/280
ACHIEVEMENT	REGENSCHEID, J.K.	83/643
ACHIEVEMENT	JENNINGS, T.	82/54
ACHIEVEMENT	ROBERTS, D.M.	79/417
ADMINISTRATORS	CARL, D.L.	84/99
ADMINISTRATORS	HOELSCHER, S.	84/99
AESTHETICS	MCISAAC, M.S.	81/428
AFFECTIVE RESPONSES	ROBINSON, R.S.	81/535
ALGORITHMIC INSTRUCTION	GERLACH, V.	80/217
ALGORITHMIC INSTRUCTION	SCHMID, R.	80/440
ALGORITHMIC INSTRUCTION	GERLACH, V.	80/440
ALGORITHMIC INSTRUCTION	VALACH, M.	80/440
ALGORITHMIC INSTRUCTION	SCHMID, R.	80/217
AMERICANESE	HARRISON, R.T.	83/776
AMERICANESE	CROSSMAN, J.	83/776
ANALYSIS	HANNAFIN, M.J.	82/325
ANXIETY	TURNER, P.M.	82/581
APTITUDE	FRENCH, M.	83/226
APTITUDE	ANGLIN, J.B.	81/1
APTITUDE	FRENCH, M.	84/178
APTITUDE	PECK, M.L.	83/561
APTITUDE	SCHWEN, T.M.	81/1
APTITUDE	ANGLIN, G.J.	81/1
ASSESSMENT	TURNER, M.L.	79/552
ASSESSMENT	ERNEST, P.S.	82/278
ATI	SCHWEN, T.M.	81/1
ATI	ANGLIN, G.J.	81/1
ATI	ANGLIN, J.B.	81/1
ATI	PARKHURST, P.E.	79/88
ATTENTION	BRAVERMAN, M.	81/78
ATTITUDES	GRABOWSKI, B.	80/220
ATTITUDES	KLOOCK, T.R.	82/439
ATTITUDES	WELLIVER, P.	80/220
ATTITUDES	SIMONSON, M.R.	82/561
ATTITUDES	HODGES, Y.A.	82/360
ATTITUDES	SIMONSON, M.	82/439
ATTITUDES	SIMONSON, M.R.	80/473
ATTITUDES	SIMONSON, M.R.	79/521
ATTITUDES	DRESANG, E.T.	82/256
ATTITUDES	REEVES, W.J.	82/360
ATTITUDES	SIMONSON, M.R.	81/586
ATTITUDES	SAVENYE, W.	83/668
ATTITUDES	COOK, S.	82/439
ATTITUDES	SHRIGLEY, R.	80220
ATTITUDES	GRAY, J.	82/360
AUDIOVISUAL PRESENTATION	MAIN, R.	79/267
AUDITORY LEARNING	OLSON, J.S.	83/517
AUDITORY LEARNING	OLSON, J.S.	84/414
AUDITORY LEARNING	BERRY, L.H.	83/517
AURAL INSTRUCTION	PECK, K.L	83/533

DESCRIPTOR	AUTHOR'S NAME	YR/PAGE
AURAL INSTRUCTION	HANNAFIN, M.J.	83/533
AURAL PERCEPTION	BRIDGES, N.	82/154
AV COMMUNICATION REVIEW	SHERIFF, D.E.	79/140
AV COMMUNICATION REVIEW	HORTON, J.A.	79/140
BEHAVIORAL OBJECTIVES	ARNOLD, T.C.	82/15
BEHAVIORAL OBJECTIVES	CANELOS, J.	80/85
BEHAVIORAL OBJECTIVES	FILAN, G.L.	79/28
BEHAVIORAL OBJECTIVES	GERLACH, V.S.	79/28
BEHAVIORAL OBJECTIVES	GERLACH, V.S.	79/241
BEHAVIORAL OBJECTIVES	DWYER, F.M.	82/15
BEHAVIORAL OBJECTIVES	SCHMID, R.E.	79/241
BEHAVIORAL OBJECTIVES	JENNINGS, T.	82/54
BEHAVIORAL OBJECTIVES	DUNN, W.	80/190
BEHAVIORAL OBJECTIVES	DWYER, F.M.	82/54
BEHAVIORAL OBJECTIVES	MAIN, R.	79/267
BEHAVIORAL OBJECTIVES	BRATTON, B.	80/190
BEHAVIORAL SCIENCE	FLEMING, M.L.	79/73
BILINGUAL EDUCATION	HARRISON, R.	80/262
BILINGUAL EDUCATION	RICKARD, D.	80/262
BILINGUAL LEARNERS	LAMBERSKI, R.	80/1
BILINGUAL LEARNERS	ACEVEDO, C.	80/1
BLACK/WHITE LEARNING	LAMBERSKI, R.J.	79/417
BLACK/WHITE LEARNING	ROBERTS, D.M.	79/417
BRAIN RESEARCH	BERBEKAR, R.	83/736
BRAIN RESEARCH	WINN, B.	83/736
BRAIN RESEARCH	JACKSON, A.	83/736
BRAIN WAVES	HINES, S.J.	82/352
CAREERS	SAVENYE, W.	83/668
CHILDREN	HANNAFIN, M.J.	82/338
CHILDREN	SAIET, R.E.	79/457
CHILDREN	BARON, L.J.	79/158
CINEMATIC ELEMENTS	ROBINSON, R.S.	81/535
CO-ORDINATION	REIGELUTH, C.	80/527
CO-ORDINATION	STEIN, F.	80/527
CO-ORDINATION	WITHAM, J.	80/527
COGNITIVE APTITUDE	BEDNAR, A.K.	79/303
COGNITIVE APTITUDE	SCHWEN, T.	79/303
COGNITIVE EFFECT	LAMBERSKI, R.	80/1
COGNITIVE EFFECT	ACEVEDO, C.	80/1
COGNITIVE LEARNING	BOVY, R.C.	81/35
COGNITIVE LEARNING	MCBRIDE, S.D.	82/69
COGNITIVE LEARNING	DWYER, F.M.	82/69
COGNITIVE LEARNING	NESBIT, L.J.	81/445
COGNITIVE SKILLS	REIGELUTH, C.	80/527
COGNITIVE SKILLS	WISE, R.E.	82/671
COGNITIVE SKILLS	WITHAM, J.	80/527
COGNITIVE SKILLS	STEIN, F.	80/527
COGNITIVE STYLE	JACOBS, R.L.	82/396
COGNITIVE STYLE	OLSON, J.S.	83/517
COGNITIVE STYLE	LEPS, A.A.	80/381
COGNITIVE STYLE	BERRY, L.H.	83/517
COGNITIVE STYLE	BURROWAY, R.L.	84/56
COGNITIVE STYLE	JONASSEN, D.H.	83/329
COGNITIVE STYLE	STREIBEL, M.J.	81/624
COGNITIVE STYLE	BERRY, L.H.	84/34
COGNITIVE STYLE	JONASSEN, D.H.	81/233
COGNITIVE STYLE	JONASSEN, D.H.	80/293
COGNITIVE STYLE	OLSON, J.S.	84/414
COGNITIVE STYLE	SCHWEN, T.	79/303

DESCRIPTOR	AUTHOR'S NAME	YR/PAGE
COGNITIVE STYLE	BRUCE, K.L.	84/331
COGNITIVE STYLE	SMITH, P.L.	84/487
COGNITIVE STYLE	MCCOMBS, B.L.	84/331
COGNITIVE STYLE	WIECKOWSKI, T.	80/594
COGNITIVE STYLE	BEDNAR, A.K.	79/303
COGNITIVE STYLES	ATANG, C.I.	84/1
COLOR	BERRY, L.H.	83/46
COLOR	WIECKOWSKI, T.	80/594
COLOR	BERRY, L.H.	82/21
COLOR	LAMBERSKI, R.J.	79/417
COLOR	ROBERTS, D.M.	79/417
COLOR	LAMBERSKI, R.	80/337
COLOR	LAMBERSKI, R.J.	82/64
COLOR	EL-GAZZAR, A.I.	84/127
COMMUNICATION	ANDERSON, C.	80/35
COMPREHENSION	TANTIBLARPHOL, S.	84/499
COMPREHENSION	LEGENZA, A.	79/351
COMPREHENSION	ROBINSON, R.S.	84/466
COMPREHENSION	PARKHURST, P.E.	82/81
COMPREHENSION	SEWELL, E.H.	79/496
COMPREHENSION	HUGHS, L.H.	84/499
COMPREHENSION	BRODY, P.J.	79/351
COMPREHENSION	MCGRADY, D.S.	84/354
COMPUTER ANXIETY	SIMONSON, M.R.	84/318
COMPUTER ANXIETY	SIMONSON, M.R.	81/549
COMPUTER ANXIETY	MAURER, M.M.	84/318
COMPUTER ANXIETY	ROHNER, D.J.	81/549
COMPUTER SIMULATION	EHRLICH, L.R.	79/631
COMPUTER-ASSISTED INSTRUCTION	HAAS, N.	84/402
COMPUTER-ASSISTED INSTRUCTION	NELSON, J.	80/389
COMPUTER-ASSISTED INSTRUCTION	STORY, N.	84/402
COMPUTER-ASSISTED INSTRUCTION	MOSLEY, M.L.	84/402
COMPUTER-ASSISTED INSTRUCTION	REGENSCHEID, J.K.	83/643
COMPUTER-BASED INSTRUCTION	KING, F.J.	84/260
COMPUTER-BASED INSTRUCTION	ROBLYER, M.D.	84/260
COMPUTERS	BRUCE, K.L.	84/331
COMPUTERS	RAGAN, T.	84/433
COMPUTERS	ROSEN, T.	83/719
COMPUTERS	HANNAFIN, M.J.	83/295
COMPUTERS	COLE, D.D.	83/295
COMPUTERS	CARL, D.L.	84/99
COMPUTERS	BURROWAY, R.L.	84/56
COMPUTERS	RAGSDALE, R.G.	82/543
COMPUTERS	WANIEWICZ, I.	83/719
COMPUTERS	HOELSCHER, S.	84/99
COMPUTERS	MCCOMBS, B.L.	84/331
COMPUTERS	SIMONSON, M.R.	84/318
COMPUTERS	ROSENSWEIG, D.	83/719
COMPUTERS	MAURER, M.M.	84/318
CONCEPT LEARNING	TURNER, P.M.	82/581
CONCRETE LEARNER	KURFISS, R.	80/327
CONCRETE LEARNING	CAREY, J.O.	81/105
CONCRETE LEARNING	HANNIFIN, M.J.	81/105
CONSUMERS	ROBERTS, D.M.	79/132
CONTENT TREATMENT INTERACTION	JONASSEN, D.H.	81/185
CONTINUING EDUCATION	NIELSON, T.	80/424
CONTROL FUNCTION	NIELSON, T.	80/424
COORDINATE CONCEPTS	LA CROIX, P.	83/370
COORDINATE CONCEPTS	JOSEPH, M.R.	83/370

DESCRIPTOR	AUTHOR'S NAME	YR/PAGE
CRITICAL DIALOGUE	BECKER, A.D.	82/469
CRITICAL DIALOGUE	MUFFOLETTO, R.	82/469
CROSS CULTURAL ANALYSIS	HEDBERG, J.G.	79/244
CUEING	TAYLOR, W.	84/72
CUEING	CANELOS, J.	84/72
CUEING	REGENSCHEID, J.K.	83/643
CUEING	DWYER, F.	84/72
CULTURAL VARIATIONS	BERRY, L.H.	83/46
CURRICULUM THEORY	KOETTING, J.R.	84/307
DEMOGRAPHIC	BOWIE, M.M	83/74
DEMOGRAPHIC	KREY, C.L.	83/441
DENTAL HYGIENE	NEWELL, K.J.	83/156
DENTAL HYGIENE	DAVIDSON, G.V.	83/156
DESIGN	FLEMING, M.	84/163
DIAGRAMS	HOLLIDAY, W.G.	81/715
DIAGRAMS	WINN, W.D.	81/715
DWYER RESEARCH	ROBERTS, D.M.	82/90
DWYER RESEARCH	CANELOS, J.	82/27
EDUCATION	MARTIN, B.L.	83/460
EDUCATIONAL DEVELOPMENT	MORGAN, R.M.	79/682
EDUCATIONAL TECHNOLOGY	ERNEST, P.S.	82/278
EDUCATIONAL TECHNOLOGY	RAGSDALE, R.G.	82/543
EDUCATIONAL TECHNOLOGY	HORTON, J.A.	83/318
EDUCATIONAL TECHNOLOGY	WINN, B.	84/607
ELABORATION THEORY	REIGELUTH, C.M.	79/100
ELEMENTARY MEDIA CENTERS	WILLIAMS, D.M.	82/621
EMBEDDED FIGURES TEST	STREIBEL, M.J.	81/624
EMPIRICAL RESEARCH	CHISWELL, J.	80/98
EMPIRICAL RESEARCH	LAMBERSKI, R.	80/98
ENCODING	TAYLOR, W.	83/125
ENCODING	DWYER, F.M.	81/120
ENCODING	SZABO, M.	81/120
ENCODING	DEMELO, H.T.	81/120
ENCODING	CANELOS, J.	83/125
ENCODING	ALTSCHULD, J.	83/125
ENVIRONMENT	TURNER, P.	79/321
ENVIRONMENT	MARTIN, N.N.	79/321
ETHNOGRAPHY	GLEASON, J.J.	81/670
ETHNOGRAPHY	WATSON-GEGEO, K.A.	81/670
ETHNOGRAPHY	GUZMAN-MALDONADO, A.A.	81/670
EVALUATION	YACOBACCI, P.M.	82/105
EVALUATION	GOLDSTEIN, M.	82/105
EVALUATION	WILLIAMS, J.A.	84/563
EVALUATION	SOLANO, F.	82/105
EVALUATION	ALTER, M.	82/105
EVALUATION	LEWIS, R.F.	79/650
EVALUATION	WILDMAN, T.	80/630
EVALUATION	BURTON, J.	80/630
EVALUATION	GENTRY, C.	81/147
EYE MOVEMENT	BARON. L.J.	79/158
EYE MOVEMENT	NESBIT, L.J.	81/445
EYE MOVEMENT	NESBIT, L.L.	82/478
FACULTY	MELLON, C.S.	82/453
FEAR	BERRY, T.	83/58
FEAR	SIMONSON, M.R.	83/58
FEEDBACK	ISRAELITE, L.	79/212
FEEDBACK	CAREY, L.M.	79/212
FEEDBACK	SCHMID, R.F.	79/212
FEEDBACK	HANNAFIN, M.	80/244

DESCRIPTOR	AUTHOR'S NAME	YR/PAGE
FIELD DEPENDENCE	SIMONSON, M.	82/439
FIELD DEPENDENCE	CANELOS, J.	81/88
FIELD DEPENDENCE	KLOOCK, T.R.	82/439
FIELD DEPENDENCE	COOK, S.	82/439
FIELD DEPENDENCE	TAYLOR, W.	81/88
FIELD DEPENDENCE/INDEPENDENCE	ATANG, C.I.	84/1
FIELD DEPENDENCE/INDEPENDENCE	DAVIDSON, G.V.	83/156
FIELD DEPENDENCE/INDEPENDENCE	SHERIFF, D.E	80/445
FIELD DEPENDENCE/INDEPENDENCE	KREY, C.L.	83/441
FIELD DEPENDENCE/INDEPENDENCE	NEWELL, K.J.	83/156
FIELD DEPENDENCE/INDEPENDENCE	WILLIAMS, J.A.	80/445
FIELD DEPENDENCE/INDEPENDENCE	CANELOS, J.	80/85
FIELD INDEPENDENCE	JOSEPH, M.R.	83/370
FIELD INDEPENDENCE	LA CROIX, P.	83/370
FIELD TEST	WINN, B.	79/580
FILM	TYSON, L.	82/519
FILM	ROBINSON, R.S.	81/535
FILM	RABURN, J.	82/519
FILM	SIMONSON, M.R.	81/586
FUNCTIONS	BRODY, P.J.	83/96
GESTALT APPROACH	BECKER, A.	80/55
HEMISPHERICITY	RANCOURT, R.	81/486
HEMISPHERICITY	DIONNE, J.P.	81/486
HIGHER EDUCATION	HEDBERG, J.G.	79/244
ICONIC STIMULUS	WISE, R.E.	82/671
ILLUSTRATIONS	SEWELL, E.H.	79/496
ILLUSTRATIONS	JOSEPH, J.	80/311
ILLUSTRATIONS	WHITAKER, J.	80/569
ILLUSTRATIONS	SULLIVAN, H.	80/569
ILLUSTRATIONS	DUCHASTEL, P.	81/137
IMAGERY	HORTIN, J.A.	84/240
IMAGERY	MOSLEY, M.L.	83/707
IMAGERY	LAMBERSKI, R.	80/93
IMAGERY	CHISWELL, J.	80/98
IMAGERY	STORY, N.O.	83/707
INDIVIDUALIZATION	RAGAN, T.	84/433
INDUSTRY	ESQUE, T.	84/394
INDUSTRY	KENNEDY, P.	83/394
INDUSTRY	NOVAK, J.	83/394
INFORMATION CUEING	TAYLOR, W.	83/125
INFORMATION CUEING	CANELOS, J.	83/125
INFORMATION CUEING	ALTSCHULD, J.	83/125
INFORMATION PROCESSING	SEWELL, E.H.	79/496
INFORMATION PROCESSING	TAYLOR, W.	81/88
INFORMATION PROCESSING	CANELOS, J.	81/88
INFORMATION PROCESSING	WINN, W.	80/646
INSTRUCTION	JENNINGS, T.	80/280
INSTRUCTION	FRENCH, M.	84/178
INSTRUCTIONAL DESIGN	BERBEKAR, R.	83/736
INSTRUCTIONAL DESIGN	KOETTING, J.R.	84/307
INSTRUCTIONAL DESIGN	BOVY, R.C.	81/35
INSTRUCTIONAL DESIGN	SIMONSON, M.	79/521
INSTRUCTIONAL DESIGN	WILLIAMS, J.A.	84/563
INSTRUCTIONAL DESIGN	DODGE, B.	80/166
INSTRUCTIONAL DESIGN	BRANSON, R.K.	79/602
INSTRUCTIONAL DESIGN	JACKSON, A.	83/736
INSTRUCTIONAL DESIGN	GRABOWSKI, B.	82/46
INSTRUCTIONAL DESIGN	MARTIN, N.N.	79/321
INSTRUCTIONAL DESIGN	GENTRY, C.	81/147

DESCRIPTOR	AUTHOR'S NAME	YR/PAGE
INSTRUCTIONAL DESIGN	REIGELUTH, C.M.	79/100
INSTRUCTIONAL DESIGN	SMITH, P.L.	84/487
INSTRUCTIONAL DESIGN	TURNER, P.	79/321
INSTRUCTIONAL DESIGN	KERR, S.T.	409
INSTRUCTIONAL DESIGN	MELLON, C.A.	82/453
INSTRUCTIONAL DESIGN	WINN, B.	83/736
INSTRUCTIONAL DESIGN	REID, G.A.	81/509
INSTRUCTIONAL DEVELOPMENT	SHERIFF, D.E.	80/445
INSTRUCTIONAL DEVELOPMENT	BECKWITH, D.	83/1
INSTRUCTIONAL DEVELOPMENT	WILLIAMS, J.A.	80/445
INSTRUCTIONAL EFFECT	DWYER, F.M.	82/15
INSTRUCTIONAL EFFECT	DWYER, F.M.	83/203
INSTRUCTIONAL EFFECT	DE MELO, H.T.	82/40
INSTRUCTIONAL EFFECT	LAMBERSKI, R.J.	82/64
INSTRUCTIONAL EFFECT	DE MELO, H.	83/203
INSTRUCTIONAL EFFECT	DWYER, F.M.	82/60
INSTRUCTIONAL EFFECT	ARNOLD, T.C.	82/15
INSTRUCTIONAL EFFECT	JOSEPH, J.H.	79/380
INSTRUCTIONAL EFFECT	DWYER, F.M.	82/40
INSTRUCTIONAL EFFECT	JOSEPH, J.H.	82/60
INSTRUCTIONAL INNOVATION	HEDBERG, J.G.	79/244
INSTRUCTIONAL MANAGEMENT	BRUCE, K.L.	84/331
INSTRUCTIONAL MANAGEMENT	MCCOMBS, B.L.	84/331
INSTRUCTIONAL MEDIA	COOK, S.	82/439
INSTRUCTIONAL MEDIA	LEVIE, W.H.	80/201
INSTRUCTIONAL MEDIA	KLOOCK, T.R.	82/439
INSTRUCTIONAL MEDIA	FLEMING, M.	80/201
INSTRUCTIONAL MEDIA	SIMONSON, M.	82/439
INSTRUCTIONAL MEDIA	WINN, B.	79/580
INSTRUCTIONAL MEDIA	MCLESKEY, J.	80/201
INSTRUCTIONAL MEDIA	SIMONSON, M.R.	80/473
INSTRUCTIONAL METHODS	MOORE, D.M.	81/471
INSTRUCTIONAL METHODS	BRODY, P.J.	84/44
INSTRUCTIONAL METHODS	OXFORD, J.F.	81/471
INSTRUCTIONAL STRATEGIES	LA CROIX, P.	83/370
INSTRUCTIONAL STRATEGIES	JOSEPH, M.R.	83/370
INSTRUCTIONAL SYSTEMS	YACOBACCI, P.M.	82/105
INSTRUCTIONAL SYSTEMS	ALTER, M.	82/105
INSTRUCTIONAL SYSTEMS	GOLDSTEIN, M.	82/105
INSTRUCTIONAL SYSTEMS	SOLANO. F.	82/105
INSTRUCTIONAL TECHNOLOGY	BURTON, J.	80/630
INSTRUCTIONAL TECHNOLOGY	WILDMAN, T.	80/630
INSTRUCTIONAL TECHNOLOGY	KOETTING, J.R.	83/416
INSTRUCTIONAL TEXTS	BRODY, P.	80/70
INSTRUCTIONAL VARIABLES	DWYER, F.M.	83/175
INSTRUCTIONAL VARIABLES	DE MELO, H.	83/175
INTEGRATED LEARNING SYSTEM	GRABOWSKI, B.	82/46
INTERACTION	PECK, M.L.	83/561
INTERACTIONS	DE MELO, H.	83/175
INTERACTIONS	DWYER, F.M.	83/175
INTERACTIONS	JACOBS, R.L.	82/396
ITV	JOHNSON, K.A.	82/404
ITV	KELLER, P.F.G.	82/404
LEARNER CHARACTERISTICS	MCLESKEY, J.	80/201
LEARNER CHARACTERISTICS	LEVIE, W.H.	80/201
LEARNER CHARACTERISTICS	FLEMING, M.	80/201
LEARNER CHARACTERISTICS	BECKWITH, D.	84/17
LEARNER INTEREST	DODGE, B.	80/166
LEARNERS	FLEMING, M.	84/163

DESCRIPTOR	AUTHOR'S NAME	YR/PAGE
LEARNERS	BECKWITH, D.	83/1
LEARNING	TAYLOR, W.	84/72
LEARNING	MAIN, R.	79/267
LEARNING	CHEZIK, M.A.	82/33
LEARNING	HOLLIDAY, W.W.	81/715
LEARNING	NESBIT, L.L.	82/478
LEARNING	DWYER, F.M.	82/33
LEARNING	WILDMAN, T.	80/460
LEARNING	CANELOS, J.	82/183
LEARNING	SHERMAN, T.	80/460
LEARNING	DWYER, F.	84/72
LEARNING	ALTSCHULD, J.	82/183
LEARNING	WINN, W.D.	81/715
LEARNING	CANELOS, J.	84/72
LEARNING	TAYLOR, W.	82/183
LEARNING HIERARCHIES	REID, G.A.	81/509
LEARNING STRATEGIES	HANNIFAN, M.J.	82/338
LEARNING STRATEGIES	HANNAFIN, M.J.	82/325
LISTENING COMPREHENSION	MANN, R.E.	79/429
MAINSTREAMING	DRESANG, E.T.	82/256
MANAGEMENT	SPLAINE, J.	81/611
MATCHING LEARNING THEORY	WILDMAN, T.	80/630
MATCHING LEARNING THEORY	BURTON, J.	80/630
MATHEMATICS	HANNAFIN, M.	80/244
MEDIA	TORKELSON, G.M.	84/534
MEDIA COMPETENCY	ANDERSON, C.	80/35
MEDIA MATERIALS	RUSSELL, A.L.	82/548
MEDIA PROGRAM	REEVES, W.J.	82/360
MEDIA PROGRAM	GRAY, J.	82/360
MEDIA PROGRAM	HODGES, Y.A.	82/360
MEDIA SPECIALIST	MARTIN, N.N.	79/321
MEDIA SPECIALIST	BURNELL, S.	79/191
MEDIA SPECIALIST	TURNER, P.	79/321
MEDIA SPECIALIST	BOWIE, M.M.	83/74
MEDIA TECHNIQUES	KERVIN, D.	84/253
MEDIA TECHNIQUES	MCLESKEY, J.	80/201
MEDIA TECHNIQUES	FLEMING, M.	80/201
MEDIA TECHNIQUES	FRENCH, M.	84/178
MEDIA TECHNIQUES	LEVIE, W.H.	80/201
MEDIA UTILIZATION	HENNIGAN, T.L.	82/311
MEDIA UTILIZATION	DRESANG, E.T.	82/256
MEDIA UTILIZATION	OXFORD, J.F.	81/471
MEDIA UTILIZATION	MOORE, D.M.	81/471
MEDIA UTILIZATION	GILBERT, R.M.	82/311
MEDIATED INSTRUCTION	CANELOS, J.	84/72
MEDIATED INSTRUCTION	SIMONSON, M.R.	82/561
MEDIATED INSTRUCTION	DWYER, F.	84/72
MEDIATED INSTRUCTION	TAYLOR, W.	84/72
MEMORY	EL-GAZZAR, A.I.	84/127
MEMORY STRATEGIES	HANNAFIN, M.J.	81/166
MEMORY STRATEGIES	JONASSEN, D.H.	79/364
MEMORY STRATEGIES	CAREY, J.O.	81/166
META-ANALYTIC	CLARK, F.	80/125
META-ANALYTIC	ANGERT, J.	80/125
MOTION CUES	SAIET, R.A.	457
MOTIVATION	HAAS, N.	84/402
MOTIVATION	STORY, N.	84/402
MOTIVATION	MOSLEY, M.L.	84/402
MOTIVATION	MOSLEY, M.L.	83/502

DESCRIPTOR	AUTHOR'S NAME	YR/PAGE
MUSIC	TYSON, L.	82/519
MUSIC	RABURN, J.	82/519
MUSIC	BRIDGES, N.	82/154
MUSIC	MANN, R.E.	79/429
NATURALISTIC INQUIRY	MCISAAC, M.S.	84/386
NATURALISTIC INQUIRY	BRODY, P.J.	84/44
NATURALISTIC INQUIRY	KOETTING, J.R.	84/290
NATURALISTIC INQUIRY	SHROCK, S.A.	83/682
NATURALISTIC INQUIRY	MELLON, C.A.	83/487
NEEDS ASSESSMENT	SPITZER, D.R.	79/543
NETWORKING	CANELOS, J.	81/88
NETWORKING	TAYLOR, W.	81/88
NONVERBAL COMMUNICATION	HARRISON, R.T.	83/776
NONVERBAL COMMUNICATION	CROSSMAN, J.	83/776
OPERATIONAL ENVIRONMENT	PARKHURST, P.E.	79/88
PERCEPTIONS	BURNELL, S.	79/191
PERCEPTIONS	CARL, D.L.	84/99
PERCEPTIONS	HOELSCHER, S.	84/99
PERCEPTUAL-MOTOR	GERLACH, V.	80/217
PERCEPTUAL-MOTOR	SCHMID, R.	80/217
PERFORMANCE	BOWIE, M.M.	83/74
PERFORMANCE	JONASSEN, D.H.	80/293
PERSUASION	GRABOWSKI, B.	80/220
PERSUASION	SHRIGLEY, R.	80/220
PERSUASION	SIMONSON, M.R.	81/586
PERSUASION	SIMONSON, M.R.	83/58
PERSUASION	BERRY, T.	83/58
PERSUASION	WELLIVER, P.	80/220
PHILOSOPHICAL FOUNDATIONS	KOETTING, J.R.	83/416
PHILOSOPHICAL FOUNDATIONS	KOETTING, J.R.	84/290
PHILOSOPHICAL FOUNDATIONS	KOETTING, J.R.	84/307
PHOTOGRAPHY	MCISAAC, M.S.	81/428
PHOTOGRAPHY	MCISAAC, M.S.	84/386
PHOTOGRAPHY	MCISAAC, M.S.	83/478
PICTORIAL ELABORATION	ACEVEDO, C.	80/1
PICTORIAL ELABORATION	LAMBERSKI, R.	80/1
PICTORIAL RESEARCH	TANTIBLARPHOL, S.	84/499
PICTORIAL RESEARCH	BERRY, L.H.	83/46
PICTORIAL RESEARCH	ANGERT, J.	80/125
PICTORIAL RESEARCH	WIECKOWSKI, T.	80/594
PICTORIAL RESEARCH	BRODY, P.J.	79/351
PICTORIAL RESEARCH	EL-GAZZAR, A.I.	84/127
PICTORIAL RESEARCH	BRODY, P.	80/70
PICTORIAL RESEARCH	MCISAAC, M.S.	83/478
PICTORIAL RESEARCH	LEVIE, W.H.	81/388
PICTORIAL RESEARCH	HANNAFIN, M.J.	84/220
PICTORIAL RESEARCH	LEGENZA, A.	79/351
PICTORIAL RESEARCH	BERRY, L.H.	84/34
PICTORIAL RESEARCH	HUGHS, L.H.	84/499
PICTORIAL RESEARCH	LEVIE, W.H.	81/388
PICTORIAL RESEARCH	CLARK, F.	80/125
PICTORIAL RESEARCH	MCISAAC, M.S.	84/386
PICTORIAL RESEARCH	BRODY, P.J.	83/96
PICTORIAL RESEARCH	BRODY, P.J.	84/44
PRACTITIONER	WHITE, B.H.	79/144
PRESENTATION MODE	SAVENYE, W.	83/668
PRESENTATION MODE	JOSEPH, J.H.	83/357
PRESERVICE TEACHERS	SHRIGLEY, R.	80/220
PRESERVICE TEACHERS	WELLIVER, P.	80/220

DESCRIPTOR	AUTHOR'S NAME	YR/PAGE
PRESERVICE TEACHERS	GRABOWSKI, B.	80/220
PRINCIPALS	BURNELL, S.	79/191
PRIOR KNOWLEDGE	RICHARDS, B.	84/446
PROBLEM SOLVING	HORTIN, J.A.	84/240
PROGRAM EVALUATION	SHROCK, S,A	83/682
PROGRAMMED INSTRUCTION	MCGRADY, D.S.	84/354
PROGRAMMED INSTRUCTION	JONASSEN, D.H.	79/3364
PROGRAMMED INSTRUCTION	BRIDGES, N.	82/154
PROSE	HANNAFIN, M.J.	84/220
PROSE LEARNING	MOSELY, M.L.	83/707
PROSE LEARNING	STORY, N.O.	83/707
PROSE MATERIAL	DWYER, F.M.	82/33
PROSE MATERIAL	CHEZIK, M.A.	82/33
PSI	JACOBS, R.L.	82/396
PSYCHOEPISTEMOLOGY	DIONNE, J.P.	81/486
PSYCHOEPISTEMOLOGY	RANCOURT, R.	81/486
PSYCHOLOGICAL PERSPECTIVE	MARTIN, B.L.	83/460
PUBLICATIONS	SIMONSON, M.	84/118
PUBLICATIONS	WINN, B.	84/607
PUBLICATIONS	DIMOND, P.	84/118
RATE-MODIFIED SPEECH	OLSON, J.S.	82/483
RATE-MODIFIED SPEECH	BERRY, L.H.	82/483
REINFORCEMENT	KORZENNY, S.S.	81/345
RELEVANCE	WHITAKER, J.	80/569
RELEVANCE	SULLILVAN, H.	80/569
RESEARCH	LUKOWSKY, J.	81/409
RESEARCH	CLARK, F.E.	82/144
RESEARCH	ROBERTS, D.M.	79/132
RESEARCH	DWYER, F.M.	79/20
RESEARCH	TORKELSON, G.M.	81/664
RESEARCH	REID, G.A.	81/509
RESEARCH	DIMOND, P.	84/118
RESEARCH	HORTON, J.A.	79/140
RESEARCH	ANGERT, J.F.	79/1
RESEARCH	SHERIFF, D.E.	79/140
RESEARCH	ANGERT, J.F.	82/144
RESEARCH	CANELOS, J.	82/27
RESEARCH	SIMONSON, M.	84/118
RESEARCH	BERRY, L.H.	82/483
RESEARCH	RAGAN, T.	84/433
RESEARCH	CLARK, F.E.	79/1
RESEARCH	KING, F.J.	84/260
RESEARCH	FILAN, G.L.	79/28
RESEARCH	ROBLYER, M.D.	84/260
RESEARCH	GERLACH, V.S.	79/28
RESEARCH	WINN, B.	84/607
RESEARCH	OLSON, J.S.	82/483
RESEARCH	SMITH, P.L.	84/487
RESEARCH	WHITE, B.H.	79/144
RESEARCH	FLEMING, M.L.	79/73
RESEARCH	TORKELSON, G.M.	84/534
RESEARCH	CANELOS, J.	82/163
RESEARCH	BECKWITH, D.	84/17
RETENTION	LAMBERSKI, R.J.	82/64
RETENTION	HANNAFIN, M.J.	83/533
RETENTION	PECK, K.L.	83/533
RETENTION	TAYLOR, W.	83/125
RETENTION	CANELOS, J.	83/125
RETENTION	ROBERTS, D.M.	82/90

DESCRIPTOR	AUTHOR'S NAME	YR/PAGE
RETRIEVAL STRATEGIES	MCBRIDE, S.D.	82/69
RETRIEVAL STRATEGIES	DWYER, F.M.	82/69
REVIEWING METHODS	NELSON, J.	80/389
ROD AND FRAME TEST	STREIBEL, M.J.	81/624
SELF CONCEPT	WILLIAMS, D.M.	82/621
SELF EVALUATION	ISRAELITE, L.	79/212
SELF EVALUATION	CAREY, L.M.	79/212
SELF EVALUATION	SCHMID, R.F.	79/212
SPECIAL EDUCATION	SOLANO, F.	82/105
SPECIAL EDUCATION	YACOBACCI, P.M.	82/105
SPECIAL EDUCATION	GOLDSTEIN, M.	82/105
SPECIAL EDUCATION	ALTER, M.	82/105
STIMULUS-EXPLICITNESS	ARNOLD, T.C.	82/15
STIMULUS-EXPLICITNESS	DWYER, F.M.	82/15
STRUCTURE	KERVIN, D.	84/253
SUBJECT KNOWLEDGE	JOSEPH, J.	80/311
SUBSUMPTIVE SEQUENCING	STEIN, F.	80/527
SUBSUMPTIVE SEQUENCING	REIGELUTH, C.	80/527
SUBSUMPTIVE SEQUENCING	WITHAM, J.	80/527
SUPPLANTATION APPROACH	FRENCH, M.	83/263
SYMBOL LEARNING	BROOKE, M.L.	8/85
SYSTEMATIC EVALUATION	DWYER, F.M.	82/2
TASK ANALYSIS	KENNEDY, P.	83/394
TASK ANALYSIS	WILDMAN, T.	80/460
TASK ANALYSIS	NOVAK, J.	83/394
TASK ANALYSIS	ESQUE, T.	83/394
TASK ANALYSIS	SHERMAN, T.	80/460
TEACHER COMPETENCE	ERNEST, P.S.	82/278
TEACHER PRACTICES	MELVIN, K.	82/197
TEACHER PRACTICES	CARRIER, C.	82/197
TEACHER THEORIES	MELVIN, K.	82/197
TEACHER THEORIES	CARRIER, C.	82/197
TEACHERS	MOSLEY, M.L.	83/502
TEACHERS	WANIEWICZ, I.	83/719
TEACHERS	ROSEN, T.	83/719
TEACHERS	ROSENSWEIG, D.	83/719
TEACHING	JONASSEN, D.H.	81/233
TEACHING	HENNIGAN, T.L.	82/311
TEACHING	GILBERT, R.M.	82/311
TEACHING	JORGENSEN, S.	81/260
TECHNOLOGY	KOETTING, J.R.	81/289
TECHNOLOGY	JORGENSEN, S.	81/260
TECHNOLOGY HISTORY	LUKOWSKY, J.	81/409
TELECONFERENCE	HANCOCK, B.W.	83/283
TELECONFERENCE	CHUTE, A.	82/235
TELECONFERENCE	HANCOCK, B.W.	82/235
TELECONFERENCE	LAPIERRE, R.C.	82/235
TELECONFERENCE	RASZAKOWSKI, R.R.	83/283
TELECONFERENCE	CHUTE, A.G.	83/283
TELEVISION	BRAVERMAN, M.	81/78
TELEVISION	ROBINSON, R.S.	84/466
TELEVISION	BECKER, A.D.	81/23
TELEVISION	KORZENNY, S.S.	81/345
TELEVISION	BARON, L.J.	79/158
TELEVISION	LEWIS, R.F.	79/650
TESTING	DWYER, F.M.	82/40
TESTING	MAURER, M.M.	84/318
TESTING	TYSON, L.	82/519
TESTING	DEMELO, H.T.	82/40

DESCRIPTOR	AUTHOR'S NAME	YR/PAGE
TESTING	RABURN, J.	82/519
TESTING	BURROWAY, R.L.	84/56
TESTING	SIMONSON, M.R.	84/318
THEORY	KOETTING, J.R.	84/290
THEORY	FILAN, G.L.	79/28
THEORY	GERLACH, V.S.	79/28
THEORY	HORTIN, J.A.	82/376
THEORY	WINN, W.	80/646
THEORY	KOETTING, J.R.	81/289
THEORY	CANELOS, J.	82/27
THEORY	TORKELSON, G.M.	84/534
THEORY	WILLIAMS, J.A.	84/563
TIME FACTOR	ATANG, C.I.	84/1
TIME-COMPRESSED SPEECH	BERRY, L.H.	83/517
TIME-COMPRESSED SPEECH	OLSON, J.S.	83/517
TIME-COMPRESSED SPEECH	HUGHS, L.H.	84/499
TIME-COMPRESSED SPEECH	OLSON, J.S.	84/414
TIME-COMPRESSED SPEECH	TANTIBLARPHOL, S.	84/499
TRANSFER OF LEARNING	RICHARDS, B.	84/446
UNIVERSITY INSTRUCTION	KURFISS, J.	80/327
UNIVERSITY INSTRUCTION	RUSSELL, A.L.	82/548
VIDEOTAPED INSTRUCTION	PECK, K.L.	83/533
VIDEOTAPED INSTRUCTION	HANNAFIN, M.J.	83/533
VISUAL CUEING	JENNINGS, T.	80/280
VISUAL CUEING	DWYER, F.M.	82/54
VISUAL CUEING	JENNINGS, T.	82/54
VISUAL LEARNING	BROOKE, M.L.	81/85
VISUAL LEARNING	WINN. B.	82/638
VISUAL LEARNING	FRENCH, M.	83/226
VISUAL LITERACY	BECKER, A.	80/55
VISUAL LITERACY	TURNER, M.L.	79/552
VISUAL LITERACY	WINN, W.	80/646
VISUAL PERCEPTION	RICKARD, D.	80/262
VISUAL PERCEPTION	HARRISON, R.	80/262
VISUAL TESTING	DE MELO, H.	83/175
VISUAL TESTING	DWYER, F.M.	81/120
VISUAL TESTING	DWYER, F.M.	83/175
VISUAL TESTING	SZABO, M.	81/120
VISUAL TESTING	DEMELO, H.T.	81/120
VISUALIZATION	HORTIN, J.A.	82/376
VISUALIZATION	JOSEPH, J.H.	83/357
VISUALIZATION	CANELOS, J.	80/85
VISUALIZATION	FRENCH, M.	83/263
VISUALIZATION	DWYER, F.M.	82/60
VISUALIZATION	MUFFOLETTO, R.	82/469
VISUALIZATION	JOSEPH, J.H.	82/60
VISUALIZATION	JOSEPH, J.	80/311
VISUALIZATION	BERRY, L.H.	82/21
VISUALIZATION	BECKER, A.D.	82/469
VISUALIZATION	HORTON, J.A.	83/318
VISUALIZATION	HINES, S.J.	82/352
VISUALIZATION	JOSEPH, J.H.	79/380
VISUALIZATION	FLEMING, M.	84/163
VISUALIZATION	TURNER, P.M.	82/581
VISUALIZED INSTRUCTION	TAYLOR, W.	82/183
VISUALIZED INSTRUCTION	CANELOS, J.	82/183
VISUALIZED INSTRUCTION	ALTSCHULD, J.	82/183
VISUALIZED INSTRUCTION	PARKHURST, P.E.	82/81
VISUALIZED INSTRUCTION	DE MELO, H.	83/203

DESCRIPTOR	AUTHOR'S NAME	YR/PAGE
VISUALIZED INSTRUCTION	DWYER, F.M.	83/203
VISUALIZED INSTRUCTION	LEPS, A.A.	80/381